ProStar 335

UV-Vis Variable Wavelength Diode Array Detector

Service manual

Installation category II
Pollution degree 2
Safety class 1 (EN 61010-1)

VARIAN

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April 2004

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1 General Information

This publication supplies information that allows a Varian-trained, Varian-qualified or Varian-authorised Customer Service Representatives to maintain and service the ProStar 335 detector. If the product is used in a manner not specified by Varian, the safety protection that is inherent in the design may be impaired.

The UV-Vis detector contains high voltages, and improper or unskilled use can cause death, serious injury or damage to equipment and property.

All users of the ProStar 335 detector must be familiar with the correct operating procedures. Site preparation and guidelines are described in the pre-installation section of this manual and in the Operation Manual publication number 85-102113-00.

The detector and accessory covers must not be removed by the operator under any circumstance.

1.1 How to use this manual

The safety practices and hazards section described below is provided to help the user operate the detector safely. Read these safety practices thoroughly before attempting to operate the detector, and always operate the detector in accordance with these safety practices.

The detector system uses interlocks and covers which are designed to prevent inadvertent contact with any potential hazards. It is good practice to develop safe working habits, which do not depend upon the correct operation of the interlocks for safe operation.

It is essential that interlocks are not bypassed, damaged or removed and all covers are properly installed when operating the detector.

All information contained in this publication is relevant to the ProStar 335 detector.

1.1.1 Finding Information

There is a comprehensive Table of Contents in the front section of the manual detailing each chapter.

Electronic and mechanical schematics including layouts and assembly drawings are included in the Schematics section of the manual.

Ordering information for spare parts is in the Spare Parts section which contains a comprehensive list of spares and their part numbers.

Service manual updates will be provided by Varian when necessary and will come in the form of diskette README file, Service Alerts or Service notes.

1.2 General Information

This section provides an overview of the ProStar 335 detector and contains important information on;

- Design features
- Fundamentals of the ProStar 335
- Safety practices and hazards
- Service philosophy

1.3 Design features

Design features include:

High performance Si photodiode array detectors

Quartz over-coated optics

Deuterium arc ultraviolet source

Tungsten halogen visible source with quartz window

Double-beam, ratio recording, polychromator

Choice of four precision flowcell varieties

Stackable module

Simple lamp replacement performed by the user

Flowcells can be easily replaced by the operator

Ethernet TCP/IP network configuration

Remote access

Fully compatible with current ProStar modules

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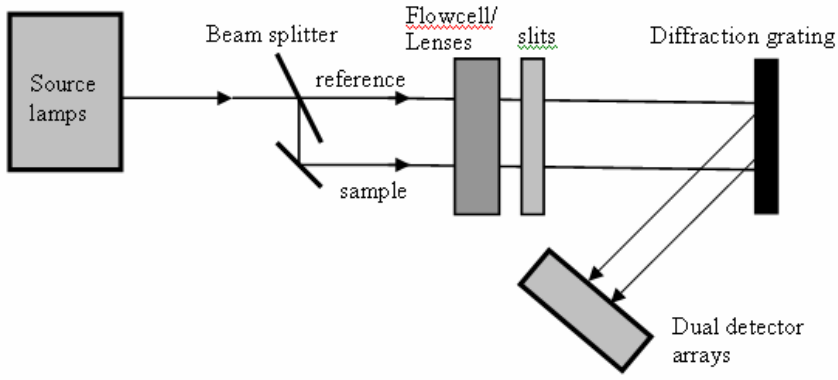
1.4 Fundamentals of the ProStar 335 detector

The ProStar 335 detector is a variable wavelength UV/Vis photodiode array detector that can be operated as a standalone HPLC detector, or it can be integrated into a Liquid Chromatography System and controlled remotely from a Star or Galaxie workstation. Using various combinations of flowcells and lamps, the detector can be adapted for applications from analytical to preparative levels. On the front panel there are no controls apart from the power ON/OFF switch and three LED indicators. The host computer is responsible for sending and receiving data and for performing all computations including the storage and display of results.
The detector measures the sample absorbance at the user selected wavelength. The absorbance is output as an analog signal to an external chart recorder and/or data collection system, or as a digital signal to Star Workstation or Galaxie. Wavelength absorbance parameters are time programmable on the standalone unit. This manual instructs the user in the installation and operation of the 335 detector for non-Workstation operation.
The detector's advanced optical design, electronics, photo diode array detectors and range of precision dual-path flowcells, make the ProStar 335 a versatile detector capable of operating in different modes. The detector can be obtained in two configurations;

1/. single array with deuterium and quartz visible lamp
2/. dual array with deuterium and quartz visible lamp

Detectors with dual array configurations use 1024 diode arrays for both the sample and reference channels.
Single array configurations for analytical work have the reference array replaced by two single photodiodes. Filters on the array suppress second order stray light.
The optical system consists of the following: deuterium lamp, visible lamp, beamsplitter, flowcell, internal optics, slits, polychromator, and linear photodiode array.
No optical alignment or mirror adjustment is possible within the detector. The source lamps come pre-aligned and can be easily replaced.
A simplified presentation of the optics configuration is shown below.



Simplified Optical System

The combined use of deuterium and visible lamps enables high light throughput across the entire spectrum from 190nm to 950nm. Both lamps are continuum lamps and for best performance only one should be selected at a time.
A silica glass beam splitter provides double beam operation. The two beams are individually passed through the optics system and into the polychromator, then to their respective photodiode detectors.

The flowcell is an integral component of the optics system. It contains a pair of lenses on each side of the flow path that precisely focus the beams onto the entrance slits before they enter the polychromator.

Note: **The flowcell must be seated correctly so that both optical beams enter the polychromator unimpeded. This is critical to detector performance.**
Refer to Installation section for details on inserting the flowcell.

There are four flowcell options available for the detector;

9x0 Analytical
9x1 Preparative
4x0.15 Super Preparative
4x0 Semi Micro

Each flowcell is easily interchangeable by the user.

Note: **Whenever the flowcell is changed for one of a different pathlength, the detector must be re-initialised to enable recalculation of electronic gain values.**

Slits are used to allow a defined bandwidth of light to pass through them. The ProStar335 has five slit width positions; 1, 2, 4, 8 and 16nm . These are located on a slit wheel and are software selectable.
The polychromator incorporates a ruled grating positioned at zero order and has a wavelength range of 190nm to 950nm. This produces the spectral range that falls onto the diode array.
The detector arrays are mounted on a plane above the grating. They are in a position where both ends of the spectrum falling onto the array are focally optimized. Alignment of the arrays, gratings or any optical component is only possible in the factory.
The outputs of the preamplifiers are digitised, processed, and either sent to a PC, or re-converted to analog. The analog circuitry produces a voltage directly proportional to the ratio of the sample signal to the reference signal. This voltage is supplied to the rear panel as the 1V/AU integrator output and as a recorder output.

The detector is compatible with the current ProStar range of products and operates under the control of the Star or Galaxie workstation software. Communication to the host PC is via an Ethernet TCP/IP link operating up to 100Mbps. This high-speed connection enables real time representation of the spectrum displayed on the workstation. Further more, it also allows the detector workstation to be integrated into a TCP/IP protocol LAN to enable remote access to any detector over an internet connection.

1.5 Detector performance testing

Detector performance tests are provided in the Verify software application. The tests available include;

Noise
Wavelength accuracy
Detector linearity (stray light)
Refractive index sensitivity
Spectral Bandwidth Accuracy (SBW)
Cell length ratio

The results of all tests performed using the Verify package are automatically stored by the system in the software directory.
Refer to Installation section for test details.

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1.6 Safety practices and hazards

Information on safety practices appears throughout the documentation provided with your detector. Before using the detector you must thoroughly read these safety practices.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Observe all relevant safety practices at all times.

1.6.1 Electrical hazards

The ProStar 335 detectors contain electrical circuits, devices, and components operating at dangerous voltages. Contact with these circuits, devices and components can cause death, serious injury or painful electrical shock.

ONLY a Varian-trained, Varian-qualified, or Varian-approved Customer Service Representative (CSR) may open panels or covers, which are retained by screws on the detector. Consult the manuals or product labels supplied with the PC, monitor and printer/plotter to determine which parts are operator-accessible.

Operators and other unauthorized personnel are permitted access ONLY to the lamp sources for replacement. ALWAYS switch off the detector before changing a lamp.

Good grounding is essential to avoid a potentially serious electric shock hazard. Ensure that there is an integral ground connection between the metal base of the detector and the 3 pin earth-grounded receptacle.

Note that the safety classification is given as Class 1 (EN 61010-1). The PC must comply with IEC 60950.

Application of the wrong supply voltage can create a fire hazard and a potentially serious shock hazard and could seriously damage the ProStar 335 system and any attached ancillary equipment.

Replace blown fuses with fuses of the size and rating as stipulated in the text adjacent to the fuse holder at the rear of the detector or, as specified in the manual.

Never use power cords with faulty or frayed insulation.

1.6.2 Lamp source

The UV and Vis lamps are enclosed in self-contained modules. Both operate at high temperatures and touching either of these may result in burns. Before replacing a lamp that has been lit, switch the detector off and ensure that you either wait for the lamp to cool, or protect your fingers from burns. The UV lamp module operates at high voltages.

When operating, these lamp sources emit high intensity UV and visible light that can cause serious damage to eyes. To avoid eye damage, never operate a lamp outside the detector.

Lamp life expectancy for both the deuterium and visible lamps is 2000 hours. When either lamp is replaced a lamp calibration is required.
See Electronics section for details.

NEVER look directly at the UV source lamp. ALWAYS wear safety glasses manufactured to an approved standard and which are certified or otherwise warranted to protect the eyes from UV radiation when the UV lamp is operating.

1.6.3 Panels and covers

Only the panel that provides access to the lamp compartments and flowcell may be removed by the operator. All other panels or covers that are retained by screws on the detector may be opened only by Varian-trained, Varian-qualified or Varian-approved Customer Service Representatives (CSRs). Consult the manuals or product labels supplied with your PC, monitor and printer/plotter to determine which parts are accessible.

Operators and other unauthorised personnel are permitted access only to the lamp compartments and Flowcell assembly.
Always switch off the detector before changing a lamp.

1.6.4 Other precautions

Do not block the rear ventilation grills on the ProStar 335. Make sure you provide adequate space behind the detector for air circulation, electrical, and communications cables.

Warning: The use of the ProStar 335 system may involve materials, solvents and solutions that are flammable, corrosive, toxic or otherwise hazardous. Careless, improper, or unskilled use of such materials, solvents and solutions can create explosion hazards, fire hazards, toxicity and other hazards which can result in death, serious personal injury, and damage to equipment and property.

ALWAYS ensure that laboratory safety practices governing the use, handling and disposal of such materials are strictly observed. These safety practices should include the wearing of appropriate safety clothing and safety glasses.

1.7 Service philosophy

1.7.1 Varian customer support policies

Warranty	12 months from install date, or 15 months from ship date.
Hardware support period	5 years from date of last unit manufacture. After this time, parts will be provided if available.

1.7.2 Service policy

In the normal course of field servicing, it is Varian's policy to troubleshoot and repair to a modular level at the detector's location.

Software diagnostic routines are available to aid in fault isolation. These are to be used in conjunction with conventional test equipment to effect on-site repairs.

In situations where minimizing downtime is the prime consideration board or module exchange should be considered, but only after preliminary attempts to repair have proven unsuccessful. Component level repair should not be attempted outside a designated service repair centre. Electronic assemblies such as the source lamp module and electronic boards with surface mount components are not field repairable.

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1.7.3 Spare parts policy

Operational spare parts for all Varian detectors and major accessories will be held in stock for a period of five years after shipment of the final production unit. Spare parts may be provided after this five-year period, but only on an "as available" basis. Operational spare parts are defined as those individual electrical or mechanical parts that are susceptible to failure through fair wear-and-tear during their normal operation. Examples include resistors, inductors, capacitors, semi-conductor devices, relays, lamps, temperature probes, detector elements, motors, wiring board assemblies and the like.
General hardware (for example, sheet metal parts, structural members, assemblies and castings) will normally outlast the useful life of the detector and therefore will only be supplied on an availability basis after the final production unit is manufactured.

Proprietary items and components that are unique to the Varian equipment should be sourced from the Varian Service Centre. Other components may be sourced locally unless otherwise specified in this manual.

1.7.4 Warranty

All Varian products are warranted against defects in materials and workmanship, but not against consequential damages. Full details relating to the terms of warranty are available from any Varian Sales and Service Office or Agency. No other warranty is expressed or implied. Consumable items such as (but not limited to) light sources, temperature probes and other glassware items are subject to a limited or pro-rated warranty. The Varian warranty provides for specific legal rights. There may also be other rights that vary from country to country, or region to region.

The warranty applies only to the installed Varian equipment, and cannot be extended to cover the associated miscellaneous installations that remain the customer's responsibility. By the same reason, the warranty does not cover problems that may be caused by misuse of the equipment, wrong applications, operator's inexperience etc. Standard Warranty will cover 12 months, 12 months from install date, or 15 months from ship date.

1.7.5 OEM Warranty

Personal Computers (PCs), printers, modems other PC accessories and OEM accessories used with the ProStar 335 are not covered by the Varian detector warranty. Generally this type of equipment is sourced locally and therefore local supplier or vendor warrantees will apply.

1.7.6 Contract maintenance

After expiry of the warranty time, service and/or repair of Varian detectors and accessories are handled on a time and materials basis, in accordance with the Varian standard service or contract maintenance arrangements. Quotations for contract maintenance may be obtained from any Varian Sales Office or Service Centre.

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2 Pre-Installation

The ProStar 335 UV-Vis detector has been fully tested and proven to specification before dispatch from the manufacturing plant.

This chapter contains general information that is relevant to the preparation of an installation site and details the facilities which must be provided to ensure that the system can be effective. Detailed operating procedures are provided in the Operation Manual that is supplied with the detector.

For installations that are to be done by Varian personnel, you should complete the Pre-installation Checklist contained in this section. Strike out any entries not appropriate to your system, and then send a copy of the checklist to the Varian Sales and Service Office or local Varian agent dealing with the supply of the equipment. On receipt of this document, the Varian Sales and Service Office or local Varian agent will contact you and arrange a convenient time for installation.

2.1 Information symbols

2.1.1 Warnings and Cautions

In this manual specific warnings and cautions detail the hazard, describe how to avoid it, and specify the possible consequences of not heeding the warning or caution.

Warning

A 'Warning' message appears in the manual or on the detector when failure to observe instructions or precautions could result in death or injury. Symbols depicting the nature of the specific hazard are also placed alongside warnings.

Caution

A 'Caution' message is used when failure to observe instructions could result in damage to equipment (Varian supplied and/or associated equipment).

A 'Note' is used to give advice or information.

Read all warnings and cautions carefully and observe them at all times.

A triangular symbol indicates a warning. The meanings of the symbols that may appear alongside warnings in the documentation or on the detector are;

Electrical shock

Eye hazard

Noxious gases

Hot surfaces

Fire hazard

Sharp object

Corrosive liquids

Moving part

Heavy weight (danger to feet)

Heavy weight (danger to hands)

Part can be ejected

The following symbol may be used on warning labels attached to the detector. When you see this symbol you must refer to the relevant operation or service manual for the correct procedure referred to by that warning label.

Information symbols

The following symbols appear on the ProStar 335 detector to provide you with additional information;

I	Mains power on
O	Mains power off
	Fuse
	Single phase alternating current
	When attached to the rear of the product, indicates that the product complies with the requirements of one or more EU Directives
	When attached to the rear of the product, indicates that the product has been certified as complying with the safety requirements of the CSA and UL
	When attached to the rear of the product, indicates that the product complies with the Australian EMC requirement

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Federal Communications Commission advisory

The following is a Federal Communications Commission advisory -

Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and operated in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures;
Reorient or relocate the receiving antenna
Increase the separation between the equipment and receiver
Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
Consult the dealer or an experienced radio/TV technician for help

CE-compliant products

ProStar 335 detectors have been designed to comply with the requirements of the Electro-magnetic Compatibility (EMC) Directive and the Low Voltage (safety) Directive (commonly referred to as the LVD) of the European Union.

Varian has confirmed that each product complies with the relevant Directives by testing a prototype against the prescribed EN (European Norm) standards.

Proof that a product complies with the Directives is indicated by -

- the CE Marking appearing on the rear of the product
- the documentation package that accompanies the product containing a copy of the Declaration of Conformity. This Declaration is the legal declaration by Varian that the product complies with the Directives, and also shows the EN standards to which the product was tested to demonstrate compliance.

It is also signed by Varian's Authorized Representative in the EU, and by the representative of the manufacturing plant.

2.2 Pre-installation checklist

If you require installation by Varian Field Service, please complete the checks on this page and send a copy to your local Varian office.

Preparation	Refer to section	Check
Work area prepared and meets requirements	2.4, 2.5	●
Power supplies meet requirements	2.6	●
The ProStar 335 detector and any accessories are on site and unpacked.	2.9	●
Computer meets requirements	2.10	●
Windows operating system installed	3.8	●
Operator training is required	2.12	●

All applicable preparations have been completed. Please arrange for the installation to be completed.

I fully understand that charges may be levied if the installation by Varian Service personnel is delayed due to facilities not being prepared in accordance with the information contained in this manual.

Company name and address: _____

_____

Signed: _____

Name: _____

Telephone: _____

Preferred installation date: _____

2.2.1 Pre-installation complete

All preparations have been completed. To arrange installation of the detector, complete the details on the back of this sheet and return a copy of the form to the Varian Office shown below.

Note: The remainder of this manual contains the environmental requirements and technical specifications for the ProStar 335 detector, and should not be discarded. Keep this manual for future reference.

Varian office card to be attached here

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2.3 Weights and dimensions

Warning

Some of the packages are large and heavy. To avoid the chance of injury to personnel or accidental damage to the equipment, always use two or more people when handling the packages or lifting equipment into position. **Never** attempt to lift the packages alone

Detector weight

System Unit	Weight	Width	Depth	Height
Detector ProStar 335	15.5kg	296mm	475mm	212mm

Shipping weight

System Unit	Weight	Width	Depth	Height
Detector ProStar 335	21kg	460mm	775mm	385mm

2.4 Environmental conditions

No draughts No corrosive fumes No vibration

Sample preparation areas and materials storage facilities should be located in a separate room.

For optimum performance the area should have a dust-free, low humidity atmosphere. Air conditioning is recommended. The room should be temperature-controlled if your analyses are particularly sensitive.

The detector will deliver best analytical performance if the ambient temperature of the laboratory is maintained between 20–25 °C and is held constant to within ±1 °C through the working day.

Caution The ProStar 335 detector is designed for operation in clean air conditions. The laboratory must be free of all contaminants that could have a degrading effect on the detector's components. Dust, acid and organic vapors must be expelled from the work area. The detector warranty will be void if the equipment is operated in substandard conditions.

Caution Operating specifications for the PC, Monitor and Printer/Plotters and other peripherals may differ from those for the Varian ProStar 335 detector. You must check in the literature provided with these units and arrange the operating environment to suit the complete system.

Suitability

The detector is suitable only for indoor use.
The detector is suitable for the following categories:

Installation category II

Pollution degree 2

Safety Class 1 (EN 61010–1)

Environmental conditions

Environment: Operation within specifications from 10 to 35°C, without failure from 0 to 50°C, and non-operational storage from -20 to 65°C. Operates in relative humidity from 5% to 95%.
For optimum analytical performance, it is recommended that the ambient temperature of the laboratory be between 20 and 25 °C and be held constant to within ±2 °C throughout the entire working day.

2.5 Workbench

The workbench must be stable and strong enough to support the total weight of equipment to be used. The worktops should be large enough to permit a free circulation of air around each unit in the system. Remember to provide space for the computer, monitor and printer. The workbench should be about 90 cm (36 in) high. To avoid damage through spillage of the mobile phase solvents used and samples being analysed, the worktops should be covered with a material that is corrosion resistant and impervious to liquids.
Allow sufficient bench space to permit installation of recorders, workstations, and other peripheral LC equipment that may be installed near it. Allow at least two inches of space on both sides, and six inches at the rear of the LC system to permit free air circulation. Power cord, signal output, and I/O connections are located at the rear of the detector. Power switches are located on the front panel on most modules, but are generally on the rear for autosamplers.

2.6 Electrical specifications

2.6.1 Mains supply

The installation of electrical power supplies must comply with the rules and/or regulations imposed by local authorities responsible for the supply of electrical energy to the workplace.

Warning

Good electrical grounding is essential to avoid potentially serious shock hazards.
A 3-wire outlet with ground connection must be provided for the detector.
Make certain that power outlets are earth-grounded at the grounding pin.

All power supplies must be single-phase AC voltage, three-wire system (active, neutral, earth) and should be terminated at an appropriate power outlet receptacle that is within reach of the detector power cord assembly. For safety reasons, a separate power outlet receptacle should be provided for each unit in the system. Do not plan to use extension cords or outlet adaptors.

All ProStar 335 detectors are supplied with a 2metre (6' 6") long power cord and three-pin plug assembly that is compatible with common standards applicable in the local area.

Avoid using power supplies from a source that may be subject to electrical or RF interference from other services (large electric motors, elevators, and welders for example).

System Unit	Required Supply Voltage	Power Rating (typical)
Detector ProStar 335	100-240VAC ±10%, 50-60Hz +/-1Hz	130 VA
Computer	100, 120, 220, 240 VAC 50/60 Hz	300 VA
Printer	100, 120, 220, 240 ±10% VAC 50/60 ±1 Hz	100 VA

Mains voltage requirements

Note For non-Varian products, the table above is indicative only. Refer to the literature provided with the computer, printer etc. for details of individual power requirements.

2.7 Fuses

ProStar 335

T3.15AH250V, IEC 127 sheet 5, 5 x 20mm

Note For safety reasons, any other internal fuse is not operator accessible, and should be replaced only by Varian-authorized personnel.

2.8 External connections

Mains inlet coupler

3/2A 120/250 VAC 50–60 Hz IEC type

Mains power cord

Australia	10A 250 VAC	Complies with AS3112
USA	10A 125 VAC	Complies with NEMA 5–15P
Europe	6A 250 VAC	Complies with CEE7 sheet vii or NFC61.303 VA

Rear connectors

J1 Comm: Ethernet TCP/IP RJ-45 type connector (system connection)
J14 Analog out: female 9-pin D-range connector
J4 Relay out: female 15-pin-D-range connector
P9 Sync signals: male 15-pin-D-range connector
J10 Sync signals: female 9-pin D-range connector

2.9 Equipment on-site

2.9.1 Insurance

As the carrier's liability ceases when the equipment is delivered, Varian recommends that the detector owner arrange a separate insurance to cover transportation from the delivery point to the installation site. The delivery point will vary according to the carrier, the shipping method and in some cases the terms of sale. Some carriers will deliver only to their own distribution centre while others may deliver to your off-loading bay. Very few carriers will deliver to the actual installation site.

2.9.2 Inspection for transit damage

Transit damage can be obvious or concealed and in either case will be admitted by the carrier only if it is reported within the terms of the carrier's agreement. For any claims against damage in transit, the following general rules apply:

> Before accepting delivery, you must inspect the packages for signs of obvious damage. The nature of any obvious damage must be noted on the carrier's waybill, which then must be countersigned by a representative of the carrier.
>
> Within the time limit stated in the terms and conditions of carriage, a further inspection must be made for concealed damage. If any damage is found at this stage, the carrier must be notified in writing. You must retain all packaging material for subsequent inspection by a representative of the carrier.
>
> A copy of any damage report must be forwarded to the Varian Sales Office dealing with the supply of your equipment.

After accepting delivery, take the equipment to the installation site, then unpack and check the contents. Varian detectors are inherently robust, and the packaging is designed to prevent internal damage. However, the contents form part of a precision measuring system and all packages should be handled with care. In transit, sharp jolts must be avoided and the packages should not be inverted or tilted unnecessarily.

Markings on the shipping cartons generally indicate which side of the package should be kept on top. In-house transit routes must be carefully considered. Vertical, horizontal and turning clearances should be calculated from the shipping carton dimensions of the detector.

Publication date: April 2004

Unpacking of the equipment is your responsibility and instructions are provided with the detector. As the packages are opened, the contents should be checked against the enclosed packing lists and any differences from the original order should be referred immediately to your Varian Sales Office. All contents of the shipping packages should be assembled together when installation is to be carried out by Varian Service personnel. Do not discard any packaging components or filler materials.

2.10 Computer interface

2.10.1 Computer requirements

The minimum configuration represents the absolute minimum you can run the software on. This PC configuration may be out of manufacture, but you may want use a PC you already have. The recommended configuration is that which you would buy new.

Minimum	Recommended
IBM compatible	IBM compatible
Intel Pentium III processor	Intel Pentium III processor
64 MB RAM	128 MB RAM
150 MB free space on hard disk	1GB free space on hard disk
3.5” 1.44 MB floppy drive	3.5” 1.44 MB floppy drive
Video card supporting 800 x 600 resolution, high color (16 bit) mode	Video card supporting 800 x 600 resolution, high color (16 bit) mode
Super VGA screen	Super VGA screen
4 x CDROM drive	16 x CDROM drive
Windows 101 key keyboard	Windows 101 key keyboard
Microsoft or compatible mouse	Microsoft or compatible mouse
Microsoft Windows®2000® (including Service Pack 2 or later), Windows NT service pack 6 or Windows XP®	Microsoft Windows®2000® (including Service Pack 2 or later), Windows NT service pack 6 or Windows XP®

Varian can supply a PC for the ProStar 335 in the recommended configuration. Consult your local salesperson for details. The operating system software will be pre-loaded. All software disks and manuals are to be supplied to the customer.

PCs supplied with Letter of Credit orders will be an international brand and will be the ‘Recommended’ configuration or better.

Better PC components can be substituted for those listed above e.g. processor type, amount of memory, screen size and resolution, operating system version etc.

For the latest information regarding compatible PC configurations, please contact your Varian representative.

2.10.2 Ethernet

The ProStar 335 detector requires an Ethernet connection to the PC via a shielded twisted pair Ethernet crossover cable Category 5 or better (provided with the detector).
If connection is required to an Ethernet network, then a shielded twisted pair Ethernet non-crossover cable Category 5 or better will be required (not supplied).

Most PC's come pre-configured with an Ethernet connection either built into the motherboard or with an Ethernet network card installed. Check that the intended PC has this configuration and if not, a network card will have to be fitted. Refer to the installation chapter for details.
If the user is supplying their own PC, then they are responsible for installing and configuring the card. They are also responsible for setting up and maintaining any LAN configuration where a detector may be used.
All network issues are to be dealt with by the users.

2.10.3 Recommended printer/plotter

You can use any printer supported by your Microsoft Windows® operating system.

The monitor, keyboard, printer/plotter and detector are connected to the PC via cables that plug into the back of the PC. Please consult your monitor and printer manuals for details of their individual cabling requirements.

2.11 Setting up your PC

2.11.1 ProStar 335 Verify software

The ProStar 335 Verify software, compatible with Windows 2000® or Windows XP®, is to be installed on your PC. For instructions on installing this, please refer to Section 3.8 Software Installation.
Ensure that you have your Display Desktop area set to a minimum 800 by 600 pixels or greater and that the Color palette is set to High color (16 bit).
Check that your sound card and CDROM drive are working.
Your Varian representative will install the ProStar 335 software during his/her visit but installation of a Windows® operating system is not included as part of the standard detector installation.

2.12 Operator training

If the ProStar 335 detector is installed by Varian Field Service, the Varian Customer Service Representative (CSR) will demonstrate the basic operating procedures while conducting the installation performance tests during the installation procedure. The CSR however, is not necessarily experienced in complex analytical routines and is not authorized to conduct extensive training.

For an additional fee you can arrange for operator training to be carried out after the installation. To check this possibility, please contact your local Varian Sales and Service Office.

As a guide to the time required for installation by Varian service, a typical ProStar 335 system will be completed and ready for use within four hours. The installation time can be kept to a minimum by ensuring proper preparation of the site and arrangement of all units to allow for easy access.

The initial Verify software installation and elementary performance tests will take around thirty minutes. There is then a period of two hours that must be allowed for warm-up before the detailed detector tests for conformance to specification can be carried out.

If your system computer was purchased from Varian, it will be configured, formatted, partitioned and loaded with its operating system. The ProStar 335 Verify software will be loaded during installation.

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Please note that you must have a working knowledge of the computer operating system, as this type of instruction is not provided by Varian. The literature supplied with the detector provides step-by-step instructions for setting up the system and detailed operating instructions for the analysis procedures—it does not include instructions for operation of the computer.

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3 Installation

3.1 Introduction

This section provides instructions for installing and maintaining the ProStar 335 detector. Where procedures differ for the various detector models they will be clearly identified. The detector is supplied with the following documentation -

- ProStar 335 Operation Manual (85-102113-00)
- Declaration of conformity
- Factory test certificates

Instructions for installing the ProStar 335 detector and verifying its performance using the Verify software, together with an overview of the system, are included in this section. Detailed operating procedures are provided in the Operation Manual and also included in the on-line help.

It is the customer's responsibility to have the operating system installed but the CSR should install the Star Workstation and Verify software.

It is also the customer's responsibility to set up and maintain their own LAN (Local Area Network).

Installation instructions for any ProStar accessory are given in the manuals accompanying those accessories. The installation instructions in this publication are provided for the guidance of Customer Support Representatives (CSRs) who have completed the appropriate product training courses and are employed or otherwise authorized by the Varian Sales and Service organization.

Installation by unauthorized personnel is not permitted and will immediately void the detector warranty. Unskilled, improper or careless installation can create the risk of fire, explosion, electric shock and various other hazards that can cause death or serious injury to personnel. All users of these systems must be familiar with correct operating procedures and safety practices as explained in this manual and in the Operation Manual.

Internal modules, covers and panels must not be removed except by Varian-trained, qualified or authorized Customer Support Representatives, unless otherwise specified.

3.2 Pre-installation

Before receiving the ProStar detector the customer will have been provided with an Operation Manual (part number 85-102113-00); which describes the environmental and operating requirements of the ProStar system and details the facilities which must be provided to ensure that the system can be effective. The laboratory must be in accordance with these instructions before the detector can be installed. The customer should keep this manual for future reference. It contains safety information and may be needed if the detector is moved to a different location. Detailed operating procedures are provided in the Operation Manual that is supplied with the detector.

Record any irregularities and inform the customer of any necessary corrective action. Postpone the installation until this is complete.

Note: You should not attempt installation until the detector has been unpacked and placed on its intended workbench. This is your customer's responsibility.

Warning

The ProStar335 detector weighs approximately 15.5 kg. To reduce the risk of injury to personnel, two people should be used for lifting, and the lifting should be done with the knees and not with the back or arms.

Heavy weight (danger to feet)

Heavy weight (danger to hands)

Check the supplied equipment for any sign of damage during transit and remove all internal packaging material.

- All items have been checked as undamaged.
- Any action required to replace parts has been taken before continuing

Record any irregularities on the Installation Checklist and inform the customer of any required actions. If required, postpone the installation until corrective action has been taken.

If there are any faults during the installation and testing sequence, you must take corrective action before continuing the installation.

3.3 Installation times

Standard installation times (including detector installation, commissioning/testing/handover) for the ProStar 335 is as follows:

Expected times for the base detector

Initialize PC		5 min
Install Verfiy software		10 min
Detector warm-up		60 min
- software tuition		
Validation and Conformance Tests		30 min
Finish	**Total**	**105 min**

3.4 Before you start

Confirm that the pre-installation preparations have been completed. You should not attempt detector installation until the detector has been unpacked and placed on its intended workbench. This is the customer's responsibility.

A copy of the pre-installation manual is in Section 2 Pre-installation. A removable sheet summarizes the state of site preparation. The customer should return this sheet to your Sales and Service Office. You should examine this sheet **before** committing to an installation date. Record any irregularities and inform the customer of any necessary corrective action. Postpone the installation until this is complete.

Unskilled, improper or careless installation may create the risk of fire, explosion, electric shock and other hazards that can cause death or serious personal injury and damage to property.

All users of the ProStar system must be familiar with the correct operating procedures and in particular with the safety practices as described in the operating manual.

Only the lamps and flowcell assembly can be removed by the operator. All other panels and covers may be removed only by Varian-trained, qualified or authorized Customer Support Representatives.

Publication date: April 2004

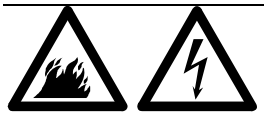
3.5 Installation

A quick reference guide for CSR's to install the ProStar335 detector is given below to ensure that you complete each step of the installation procedure. You may need to refer to this information if you re-locate the detector.

At the end of this section there is an Installation Acceptance Checklist which you must complete during installation of the detector.

3.5.1 Installation guide

- ❑ Installation Acceptance Checklist has been completed. A copy of this checklist is at the end of this chapter. Make copies as required.
- ❑ Packing list checked as consistent with order
- ❑ All items consistent with packing list
- ❑ Detector is unpacked and placed on its intended workbench by the customer as described in the Unpacking Instructions included in the packing crate
- ❑ All items checked as undamaged
- ❑ Suitable PC and printer configured correctly, as described in the pre-installation section.
- ❑ The monitor, printer/plotter and keyboard connected to the PC, and the PC connected to the mains power supply.
- ❑ Software installed as described in this manual
- ❑ Ethernet connection is configured in the PC as described in this section
- ❑ READ.ME file(s) checked for the latest release information
- ❑ Detector fuses checked as suitable for local mains supply voltage.



Warning

Application of the wrong supply voltage can create a fire hazard or a potentially serious shock hazard and could seriously damage the detector and any attached equipment.

- ❑ Detector is connected to the PC and the system connected to the mains power supply.
- ❑ Detector is turned on and allowed to stabilize for two hours. During this time you can unpack any accessories and familiarize yourself with the software.
- ❑ Detector tests done as described in this section
- ❑ Accessories supplied with the detector unpacked and checked for completeness against the packing lists enclosed in the packing crate and inside each accessory box
- ❑ All items checked as undamaged
- ❑ Installation section of the Operation Manual has been read for each accessory to determine the order in which they need to be installed

(depending on your software the accessory manuals may be on-line) and the accessories installed according to the instructions

3.6 Installation of Door Cap

If the ProStar 335 is the top module in the stack, the door cap should be installed prior to installing the door on the module. If the ProStar 335 is not at the top of the stack, do not install the cap and proceed to the next section describing door installation.

Take the cap from the accessory kit and remove the protective paper exposing the adhesive that will attach the cap to the door. Orientate the door and cap as shown in Figure 1 with the door standing on a flat surface. Insert cap into door and press adhesive onto inside of door lip as shown in Figure 2. Be sure to keep door edges and cap edges flush.

Figure 1 Door and Door Cap Orientation

Publication date: April 2004

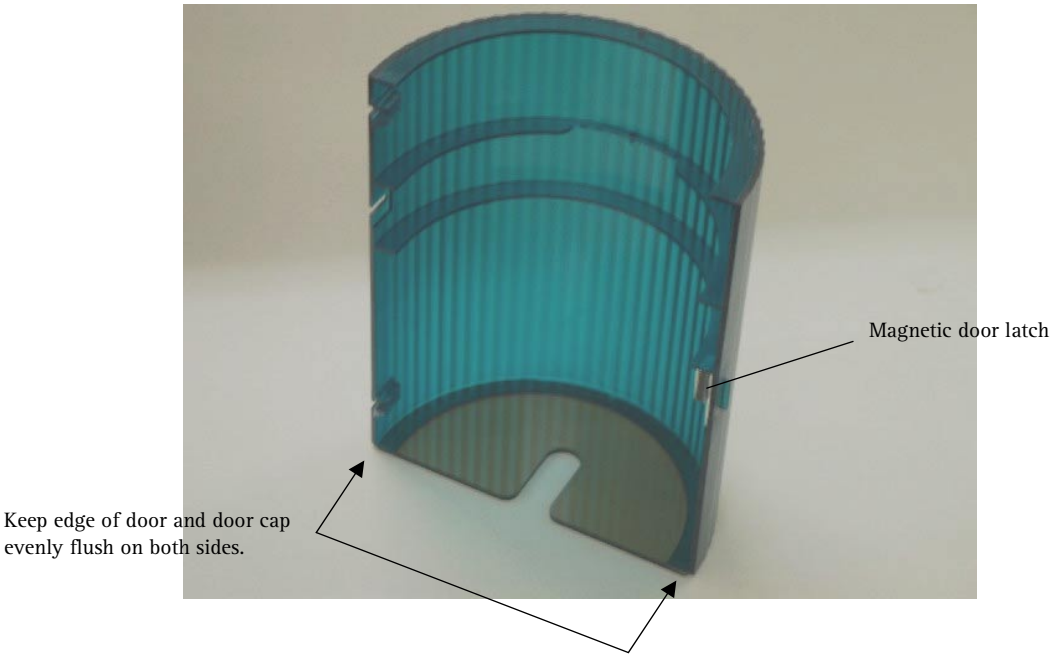


Figure 2 Door and Door Cap Assembly

3.7 Installation and Removal of Door

The module door may be attached to the front of the ProStar 335 to cover the tubing connections to the flowcell, see below.

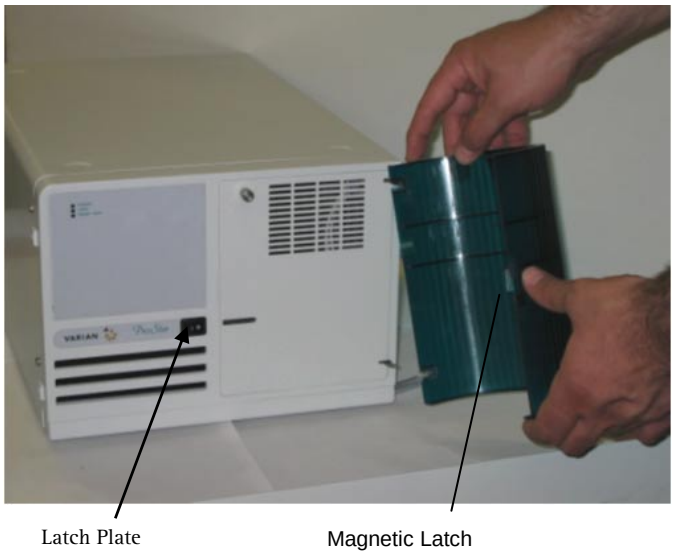


Figure 3 Door Installation

Orientate the door so that the magnetic door latch lines up with the latch plate. Insert the top hinge pin into the top hinge. Gently press down on the top of the door (as shown in Figure 3) and slide the lower hinge pin into the lower hinge and stop pressing. The door should now pivot on the pins and close against the magnetic latch.

To remove the door, gently push down on the door and slide the lower hinge pin out of the lower hinge. Now lift and slide out the top of the door.

3.8 Software Installation

This section assumes that the Microsoft Windows operating system has been installed on your PC. For instructions on installing the required Microsoft Windows operating system please refer to the documentation supplied with the Windows operating system software.

It is the customer's responsibility to have the Windows operating system installed where required, but the CSR should install the Star Workstation and Verify software.
All software is on a self-loading CD that will automatically run when inserted into the CD ROM drive. Follow the prompts to complete the installation.

Note: you must be logged in as an Administrator (or as a user with Administrator privileges) to install the software.

3.8.1 Installing Verify software

A reference guide to installing the Verify software is shown here.
To install the software:

- Turn on your PC.
- When the PC has booted up, insert the ProStar335 Verify CD into the CDROM drive.
- Select the "Install Software" button in the window that appears.
- Follow the instructions appearing on the screen. During the installation you will be asked to specify, amongst other things, the drive on which to install the software.

When the installation is complete you should have a ProStar program group on the desktop containing a Verify icon. The installation also places a ProStar folder in the Start/Programs menu.

- Read the "Readme.txt" (late-breaking news) document supplied with the software for the latest release information about the software release.
- Pass this document on to the customer.
- Reboot the PC so that any new settings can take effect.

3.9 Ethernet connection

Most new PC's come with a pre-configured network interface so there is nothing you need to do. If, however, you have a PC that has no network interface, you will need to install an Ethernet Network Interface Card (PCI bus) with a RJ-45 type connector. The PC must have a spare PCI slot for the installation of this device.

Each detector will come pre-configured with a unique MAC (Media Access Control) address. You will be required to enable communications between the detector and PC and allocate IP addresses for each detector. The detector however will allow only one TCP/IP connection at a time.

3.9.1 Networks

Since the ProStar 335 Detector communicates with the Workstation over a standard Ethernet connection, your system can easily be expanded from a single ProStar Detector/single Workstation configuration, to multiple ProStar Detectors/multiple Workstations, to a fully networked lab with a virtually unlimited number of Detectors and Workstations. The term Ethernet refers to the cables and interface cards that are used to connect devices on the network. Several types of Ethernet cables exist, and if you are connecting your ProStar 335 Detector to an existing Ethernet network, you will need to know which type of cable you are using.

Publication date: April 2004

The ProStar 335 Detector uses TCP/IP (Transmission Control Protocol / Internet Protocol) to communicate over the Ethernet network. The term TCP/IP refers to the software protocol that allows various devices to communicate with each other. Communications over the Internet and the World Wide Web use TCP/IP. Since the ProStar 335 Detector uses TCP/IP to communicate with the Star Workstation, the Workstation PC and the ProStar 335 Detector need to be given unique IP addresses—the addresses that are used to identify each networked TCP/IP device. This manual describes the process by which you give the PC and Detector unique IP addresses.

You may connect your Workstation and ProStar 335 Detector directly to each other.

We refer to this type of special purpose network as an isolated network (one that does not have IP addresses prescribed by a Network Administrator).

You may also connect your Workstations and ProStar 335 Detectors to an Ethernet network used for purposes other than detector control (such as Internet access or file server access).

We refer to this type of multi-purpose network as a company network, and a Network Administrator in your company will typically manage it. If this is the case, then follow the instructions for configuring your ProStar 335 Detector and Workstation for use on a company network.

The ProStar 335 Detector is provided with its IP address either by the Star Workstation or by software running on your network. The software used to send IP addresses to TCP/IP devices is called a BOOTP Server (Bootstrap Protocol Server). You will see the term BOOTP Server mentioned in this section. If you are connecting your ProStar 335 Detector and Workstation to a company network, your Network Administrator should be made aware that the ProStar 335 Detector will require a BOOTP Server for IP address assignment.

3.9.2 Where to Begin

Before beginning the configuration process, you should know whether you will be attaching your Workstation and ProStar 335 Detector to a company network (as described in the previous section) or an isolated network only used for detector control. If you have a Network Administrator on site, you may wish to ask which configuration is recommended.

If an Ethernet card has not been installed and configured on your PC, read the next section " Installing and Configuring the Ethernet Card in Your PC" and then one of the following:

- No Company Network: *Configuring TCP/IP Parameters with No Company Network*.
- Company Network: *Configuring TCP/IP Parameters for a Company Network*.

3.9.3 Installing and Configuring the Ethernet Card in Your PC

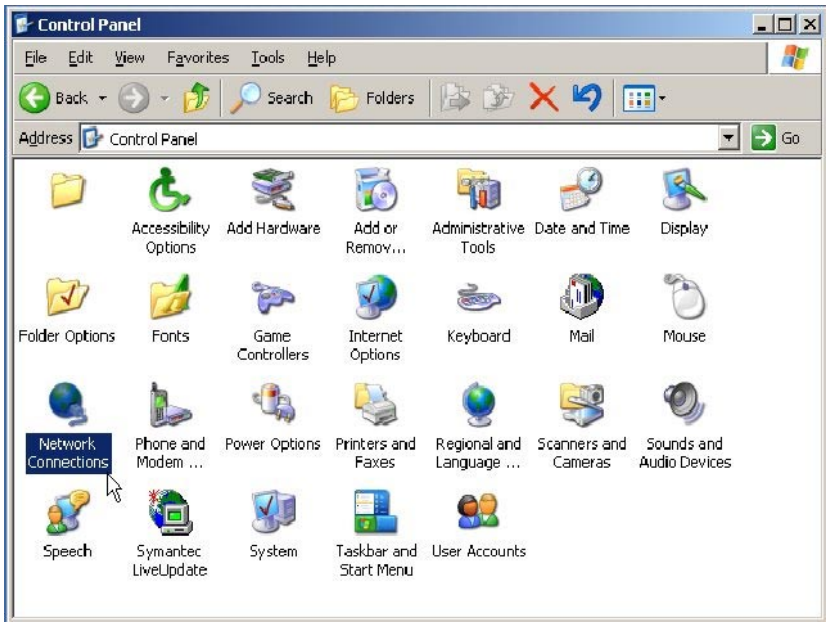
NOTE: The following section describes a procedure specific to Windows 2000. If you are running Windows NT Service pack 6 or WINDOWS XP, the windows and dialog boxes shown will differ slightly from those you see on your system, but the procedure described here is essentially the same as the one for Windows NT Service pack 6 and WINDOWS XP.

Refer to the installation instructions packaged with your Ethernet card for information on installing the Ethernet card in your computer and configuring the card in Windows. Before proceeding, your Ethernet card should be recognized by Windows (the appropriate driver has been loaded and can be configured from the Windows Control Panel). When done, the Network Neighborhood icon should appear on your Windows desktop.

NOTE: For the following procedure, the use of disks other than the ones that were used for the original Windows installation may result in an Ethernet driver version mismatch that will prevent Windows from starting. Should this occur, it might be necessary to remove the Ethernet Board from the computer to remove the incorrect Ethernet drivers.

You must configure your computer's network settings to allow communication with the ProStar 335 Detector. You do so by running the Windows Control Panel.

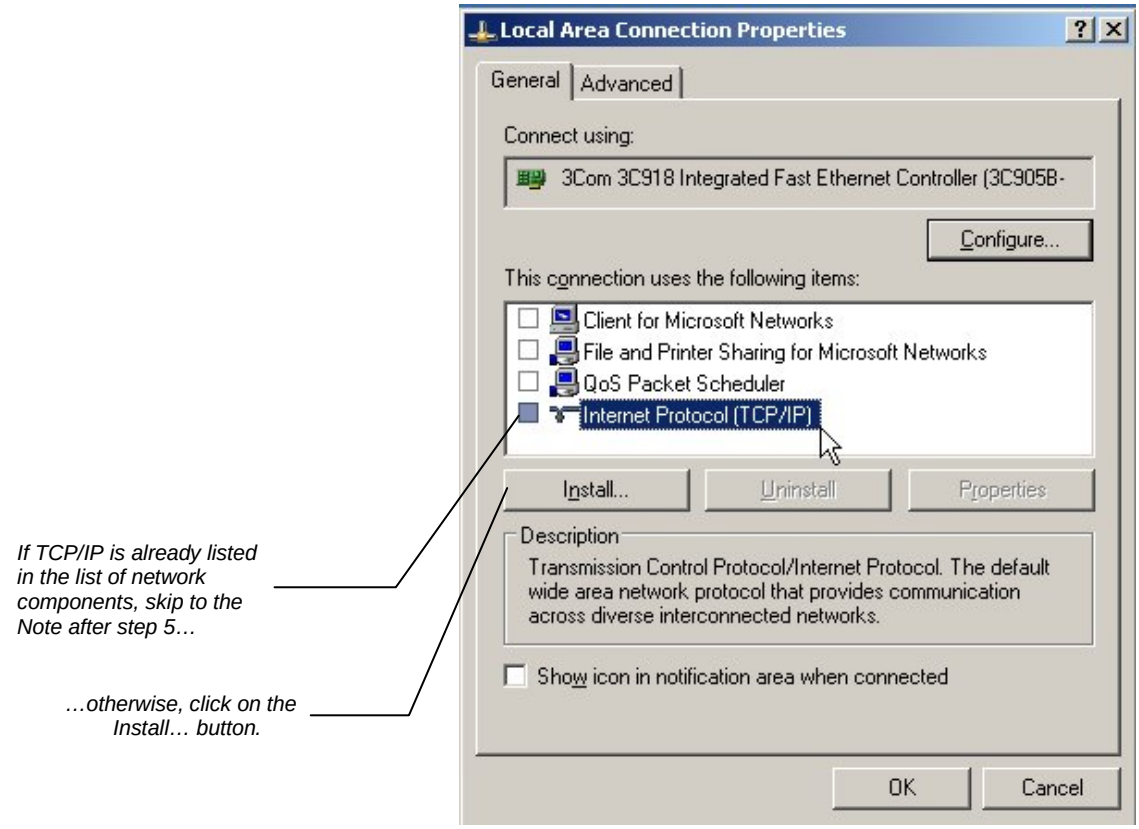
1. Run the Windows Control Panel by selecting it from the Start menu (under *Settings*).
2. The Control Panel window is displayed.



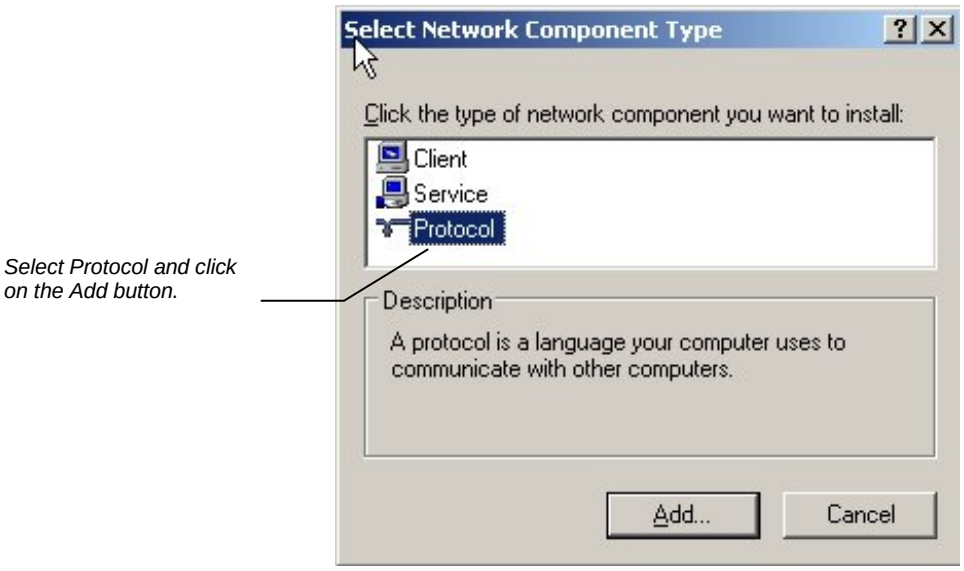
Double-click on the Network Connection icon to set your Network options.

3. Double click on Local Area Connection and the following *LAN Connection Properties* dialog box is displayed.

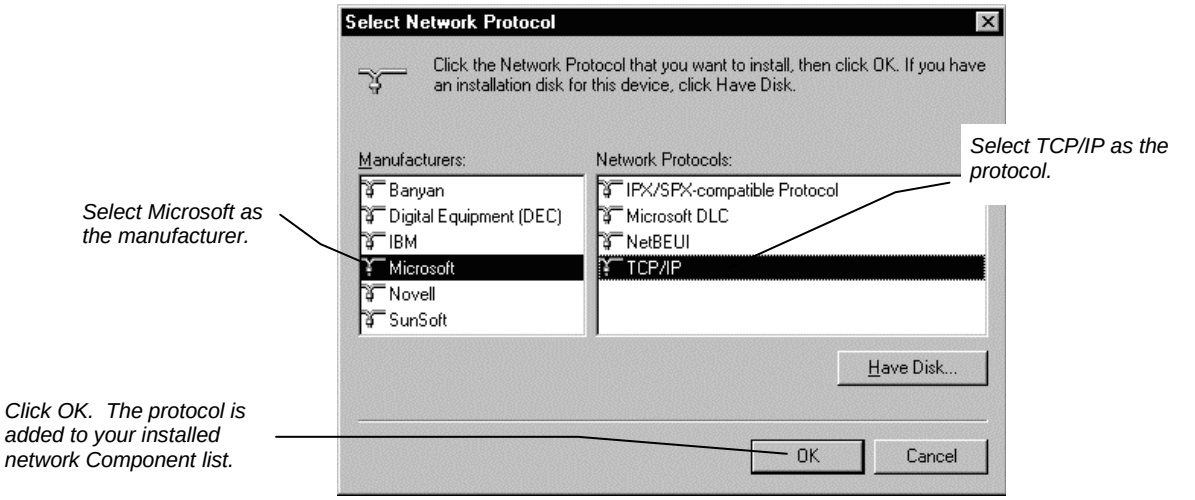
Publication date: April 2004


Local Area Connection Properties
General
Advanced
Connect using:
3Com 3C918 Integrated Fast Ethernet Controller (3C905B-
Configure...
This connection uses the following items:
Client for Microsoft Networks
File and Printer Sharing for Microsoft Networks
QoS Packet Scheduler
Internet Protocol (TCP/IP)
Install...
Uninstall
Properties
Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
Show icon in notification area when connected
OK
Cancel
If TCP/IP is already listed in the list of network components, skip to the Note after step 5…
…otherwise, click on the Install… button.

4. The *Select Network Component Type* dialog box is displayed.


Select Network Component Type
Click the type of network component you want to install:
Client
Service
Protocol
Description
A protocol is a language your computer uses to communicate with other computers.
Add...
Cancel
Select Protocol and click on the Add button.

5. The *Select Network Protocol* dialog box is displayed.

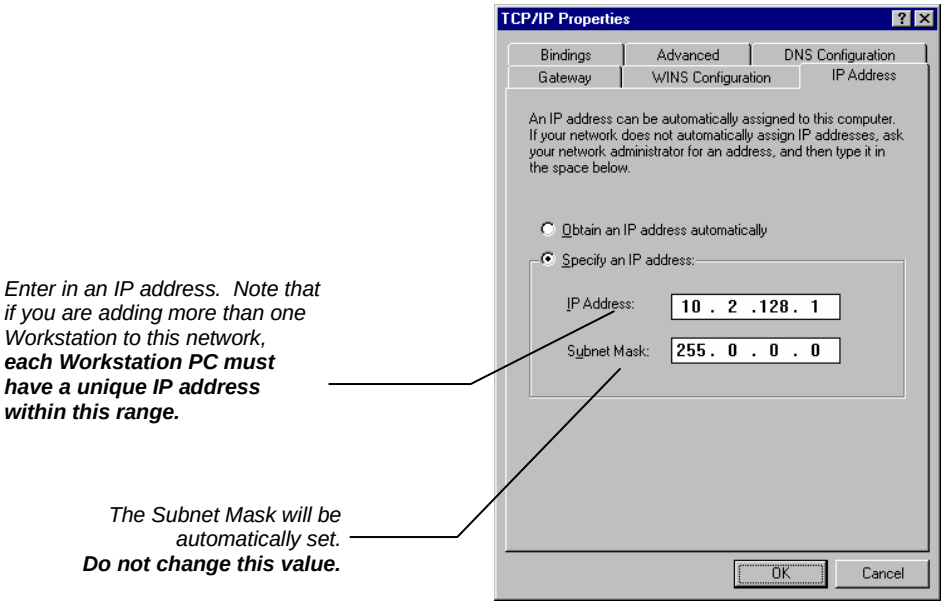


NOTE: If you *are not* connecting your Workstation to a company network (that is, you *are not* assigning an IP address by a Network Administrator), follow the next three steps. If you *are* connecting your Workstation to a company network, skip to *Configuring TCP/IP Parameters for a Company Network*.

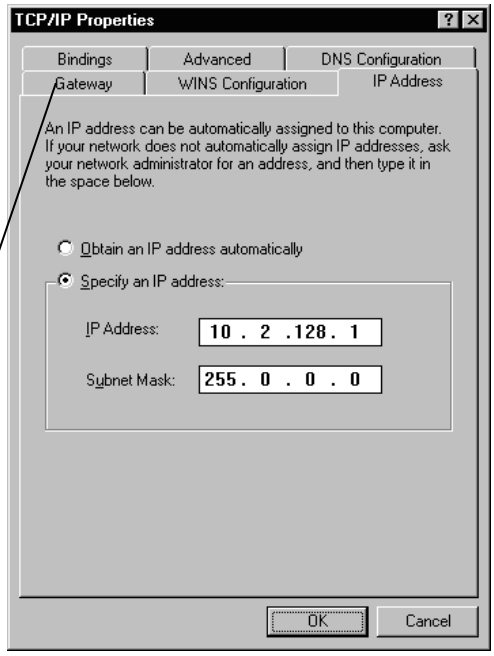
3.9.4 Configuring TCP/IP Parameters with No Company Network

The following three steps assume you have completed steps 1 through 5 from the previous section.

1. Select TCP/IP from the network component list and click on the Properties button. The *TCP/IP Properties* dialog box is displayed.


TCP/IP Properties
Bindings
Advanced
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
10 . 2 .128. 1
Subnet Mask:
255. 0 . 0 . 0
OK
Cancel
Enter in an IP address. Note that if you are adding more than one Workstation to this network, each Workstation PC must have a unique IP address within this range.
The Subnet Mask will be automatically set. Do not change this value.

Ensure that no entries have been made in your Gateway, and that Domain Name Server (DNS) and WINS Configuration have been disabled. ***These entries are not used in an isolated network and may cause problems if they are present.*** *Delete any settings that may have been entered from a previous configuration.*


TCP/IP Properties
Bindings
Advanced
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
10 . 2 .128. 1
Subnet Mask:
255. 0 . 0 . 0
OK
Cancel

2. Click on OK, and you will need to reboot Windows for the changes to take effect.

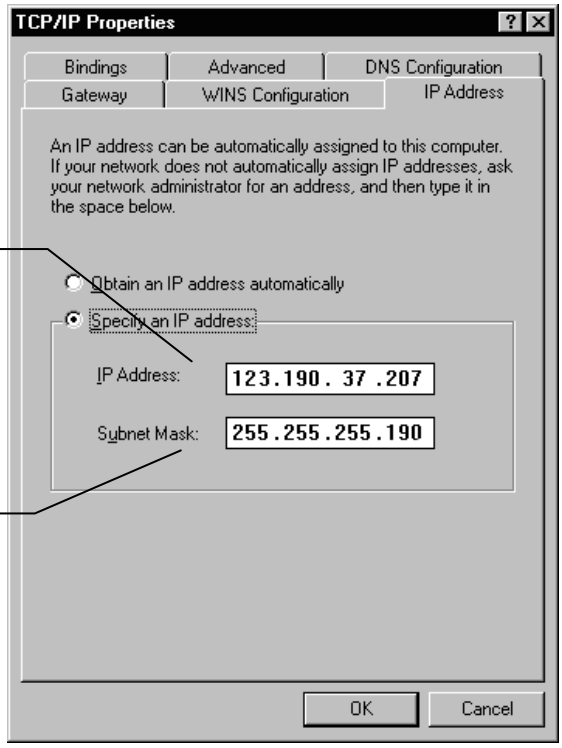
3.9.5 Configuring TCP/IP Parameters for a Company Network

The following three steps assume you have completed steps 1 through 5 from the procedure *Installing and Configuring the Ethernet Card in Your PC.*

1. Select TCP/IP from the network component list and click on the Properties button. The *TCP/IP Properties* dialog box is displayed.

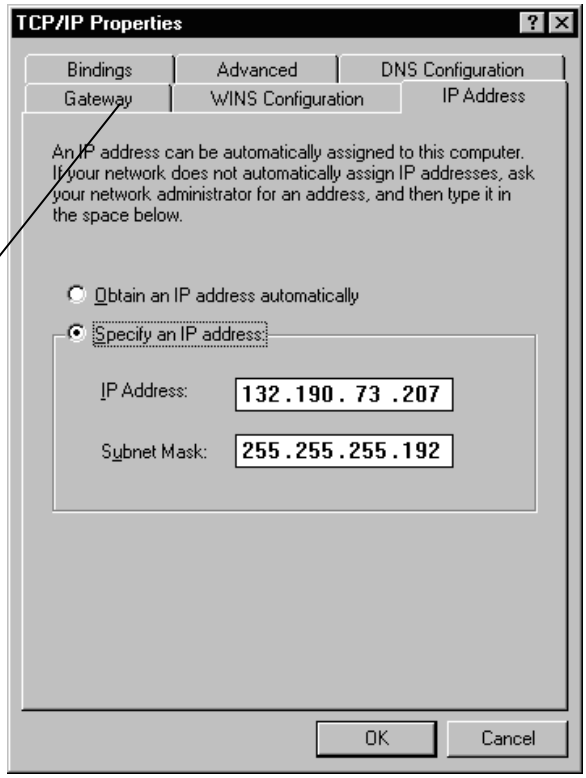
Enter the IP address to be used by this Workstation. Contact your Network Administrator (or whoever assigns IP addresses in your network) to get the appropriate address. ***Note that each Workstation PC must have a unique IP address.***

Enter the appropriate Subnet Mask to be used with this IP address.


TCP/IP Properties
Bindings
Advanced
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
123.190. 37 .207
Subnet Mask:
255.255.255.190
OK
Cancel

2. Your Network Administrator may instruct you to obtain an IP address automatically by selecting the appropriate radio button.

Contact your Network Administrator to see what the appropriate settings are for your Gateway, and whether Domain Name Server (DNS) and WINS Configuration are needed.



3. Your Network Administrator may also instruct you to specify parameters in the *Bindings* and *Advanced* tabs.
4. Click on OK in the *Network* dialog box. You will need to reboot Windows for the changes to take affect

3.10 Electrical connection

Before connecting the detector to the power supply, ensure that both the detector and the power supply are turned **off** (the power switch O is pressed). The power switch is a rocker type switch located on the front panel that connects directly to the power receptacle on the rear panel.
Press I for on, O for off.
Note: Do not connect the detector to the mains power supply until you have made sure that the two line fuses on the rear panel of the detector are of the correct type and rating.
The ProStar 335 UV/Vis Detector can be operated with any line voltage in the range of 100-240Vac +/-10%, 50-60 Hz. +/-1Hz.
Plug one end of the power cord into the power receptacle on the back panel and the other end into your AC power source.
All devices in the liquid chromatography system should be connected to the same power source, using a properly grounded (3rd wire to earth) multiple outlet power strip.

It is important for operator safety and proper operation of the ProStar 335 UV/Vis Detector that you use the power cord supplied, together with a properly grounded 3-wire power strip.

Publication date: April 2004

3.11 Fuses

The ProStar335 contains two fuses which are located at the back of the detector. To replace a fuse, disconnect the detector from the power supply, and replace the blown fuse with one of the type and rating as indicated in the Specifications section of this manual or on the silk screening adjacent to the fuse holder.

The fuses have a code marked on the cap (e.g. T3.15AH250V). This refers to the fuse characteristic ('T' - time lag, 'F' - fast acting), the current rating ('x' amperes), the breaking capacity ('H' - heavy, 'L' - low) and the voltage rating ('y' volts). This code must correspond to the code appearing next to the fuse holders.

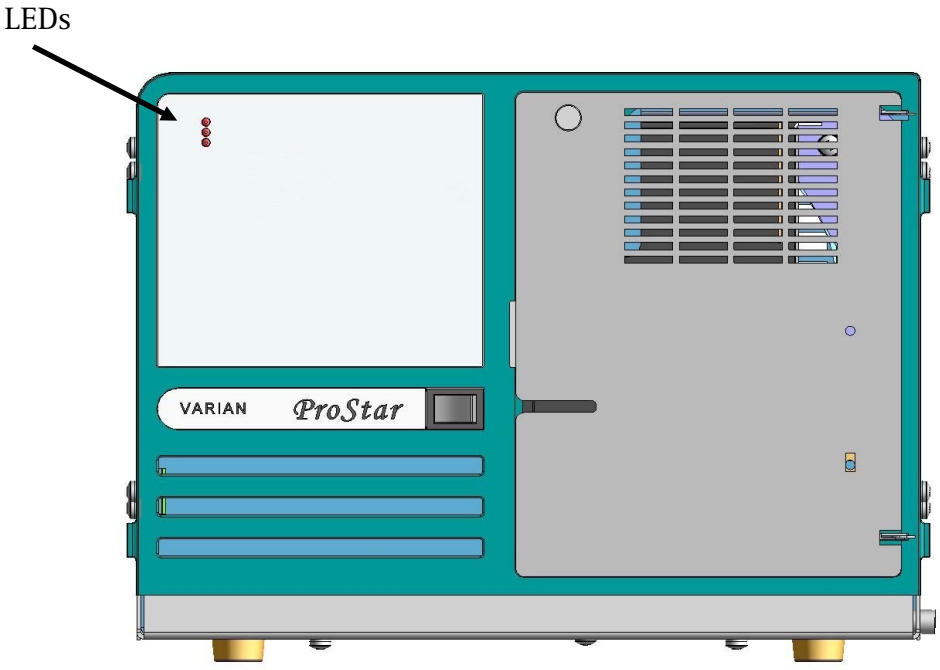
For details on checking and replacing fuses see Electronics section.

3.12 Power Up

After connecting the detector to AC power, press I on the power rocker switch. The detector will switch on and execute its start-up routine.
If your detector fails to power up when the power switch is turned on, check that the power cord is properly connected, that the fuses are ok and that there is power at the wall receptacle.
Please refer to the Electronics section of this manual for details on the initialization routine.

3.13 Front Panel LEDs

The front panel has 3 dual colour LEDs that indicate the detector's status during its stages of initialisation and operation.
The color coding for each one is defined in the table below.



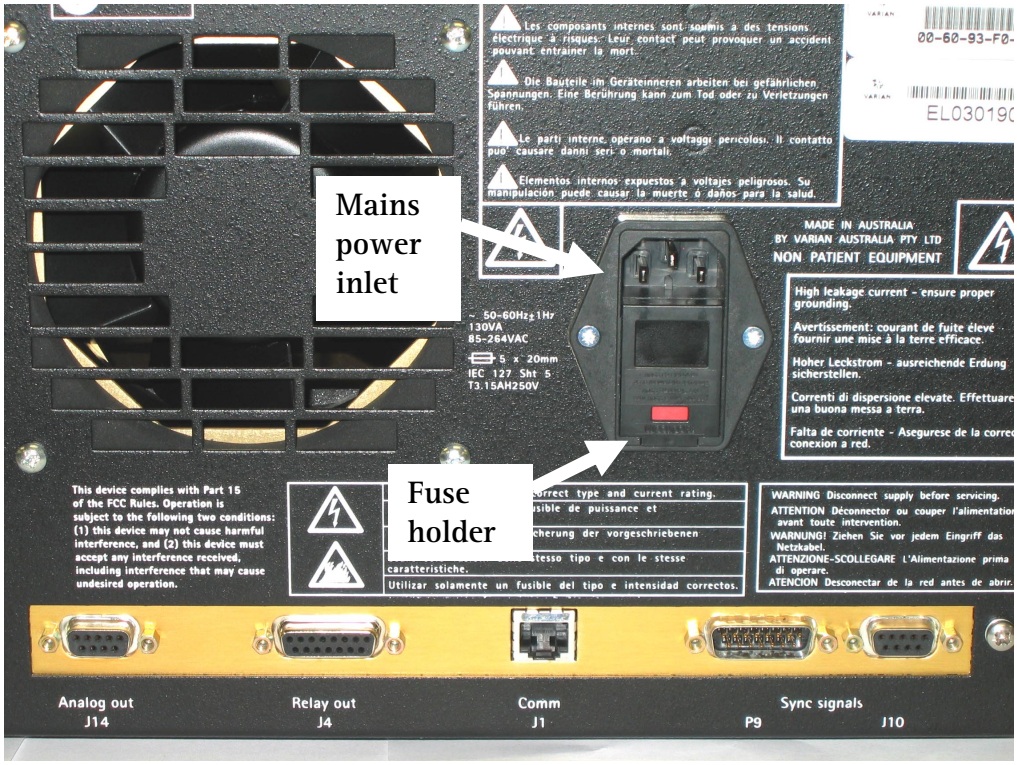
Led	Status	Color
Power	Initializing Power On	Yellow flashing Green
Lamp	Lamp On Fault	Green Red
Ready/Run	Not Ready Ready/Stopped Method Running	Off Green Yellow

3.14 Detector setup

Cabling

The monitor, printer/plotter and detector are all connected to the PC by cables that plug into the back of the PC. Consult your monitor and printer/plotter manuals for details of their cabling requirements.

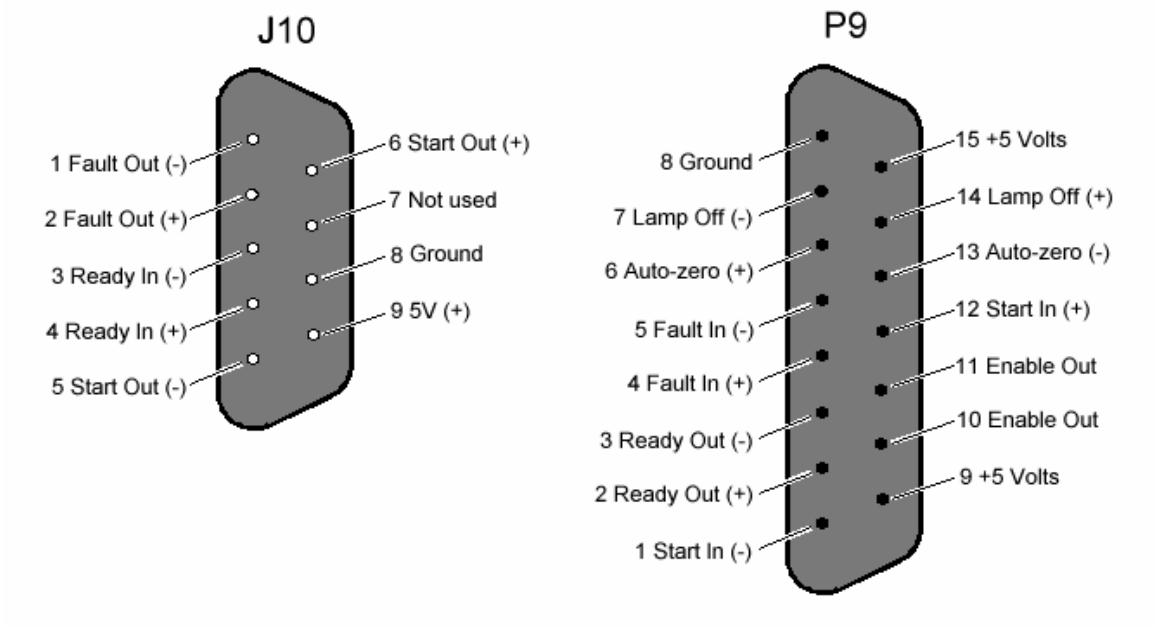
J1 Comm: RJ-45 type connector used to interface the ProStar335 to the PC by using a 100ohm shielded twisted pair Ethernet crossover cable Category 5 or better.
J10 Sync signals: female 9-pin “D” range connector used with synchronization signal cables.
P9 Sync signals: male 15-pin “D” range connector used with synchronization signal cables.
J4 Relay out: female 15-pin “D” range connector used to control the four programmable external event relays and peak sense relay.
J14 Analog out: female 9-pin “D” range connector for Analog output channels A & B.
Electrical connection: the universal mains power inlet connection is located at the rear of the detector.



Publication date: April 2004

3.15 Synchronization Signals at P9 and J10

These signals are used to synchronize the operation of a group of detectors that are not interfaced to a Workstation via a GPIB interface.
P9 and J10 pin designations are shown below. The SYNC signals come in four pairs and define how the detector will operate in an HPLC system. These signals are important for controlling timing and synchronization of the detector with the other devices in the system. SYNC signals are closely tied to the detector states and transitions.



Pin Designations for P9 and J10

An input is activated or said to be present when its two signal wires are connected together. This is quite often done with a relay contact closure. If the inputs are driven from another detector with optical isolators or other polarized devices, then attention must be paid to the polarity of the signal wire connections. The positive (+) output signal must be connected to the positive (+) input signal and the negative (-) output to the negative (-) input. The color coding and physical design of the cable connectors ensure that correct signals and polarity are matched.

The outputs are optical isolators and simulate a relay contact closure when they are activated. See Figure 4 below.

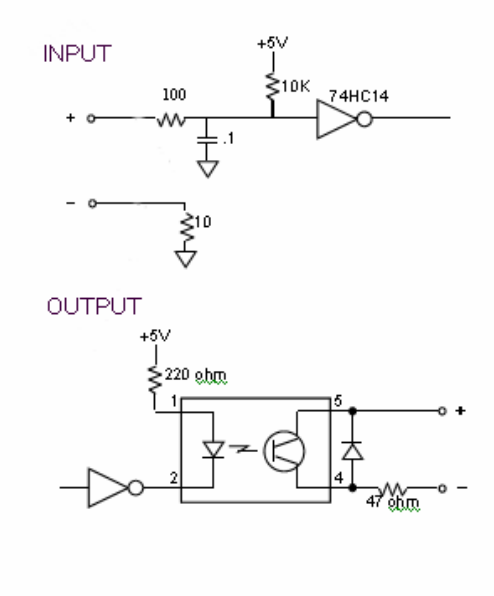


Figure 4 Input/Output Schematics

Enable Out: A non-polarized constantly active output (a short). This output can be used to activate Enable In on the next detector.

Ready In: When Enable In is set (software switch) this polarized input signal must be present before the ProStar 335 can go to the READY state.

Specifically, when the ProStar 335 is in the NOT READY Lamp On state, on receiving a Ready In signal, a monitor period will occur after which the detector goes to the READY state. It must stay active until the ProStar 335 starts. Ready In will be ignored in all other states.

Ready Out: This polarized output signal indicates that the ProStar 335 is in the READY state and is ready to start a time program.

Start In: This polarized edge triggered input signal will start the active method if the ProStar 335 is in the READY state.

Start Out: This polarized output signal will be activated for 600 milliseconds when the ProStar 335 starts a time program.

Fault In: This polarized edge triggered input signal informs the ProStar 335 that a fault condition exists in another detector in the system. The ProStar 335 halts the time program and sends a Fault Out signal. The source lamp can be programmed to either remain on or turn off upon receiving a fault signal.

Fault Out: This polarized output signal will activate for 600 milliseconds when either of the following conditions occurs:

1. The ProStar 335 discovers an internal fault condition that warrants aborting the run.
2. The ProStar 335 receives a Fault In signal and it has no internal fault condition itself.

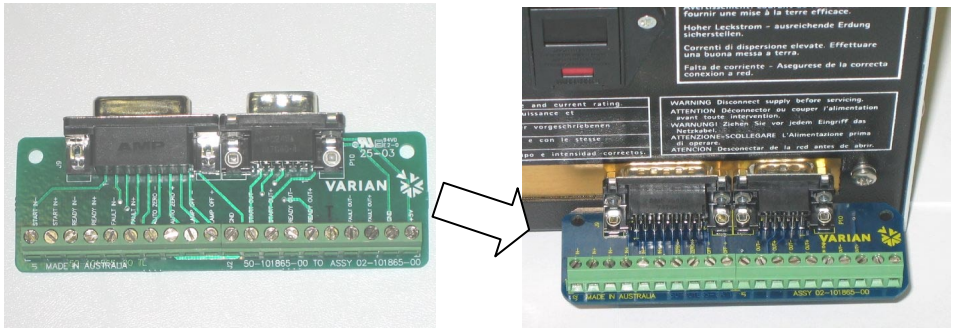
Autozero: This edge-triggered contact closure causes an autozero adjustment.

Lamp Off: This edge-triggered contact closure switches the lamp off. It is possible to turn the lamp back on manually if the contact is still closed.

Publication date: April 2004

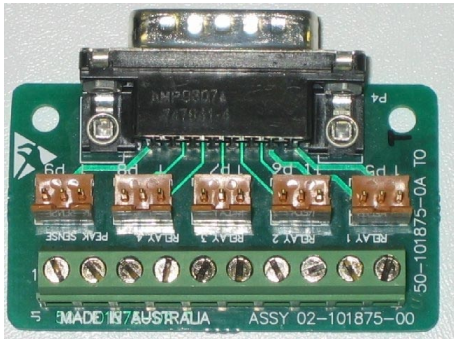
3.16 Rear Panel Accessory Interface PWB

To connect open-ended wires to the Sync signals available at P9 & J10, use Rear Panel Accessory Interface PWB (p/n 02-101865-90).
Simply plug this PWB into the rear panel connectors as shown. Use bare wire leads to connect to other devices.


VARIAN
MADE IN AUSTRALIA
50-101865-00 TO ASSY 02-101865-00
WARNING Disconnect supply before servicing.
ATTENTION Déconnecter au couper l'alimentation avant toute intervention.
ATTENZIONE-SCOLLEGARE L'Alimentazione prima di operare
ATENCION Desconectar de la red antes de abrir.
Hoher Leckstrom – ausreichende Erdung sicherstellen.
Correnti di dispersione elevate. Effettuare una buona messa a terra.
Falta de corriente – Asegurese de la correcta conexion a red.

3.17 Rear Panel Relay Interface PWB

To connect open-ended wires to the relay signals available at the rear panel connector J4, use Assy PWB Relay Interface (p/n 02-101875-90).
Simply plug this PWB into the rear panel connector.



3.18 Detector States

The detector has 6 states NOT READY, INITIALISING, MONITOR, READY, RUNNING and STOPPED. Transition between the states will depend on the current state and a number of signals, specifically SYNC signals, and/or a number of internal events which can also cause state transitions.

NOT READY, LAMP OFF – Detector is not ready for a run, but is usable. It will be in this state after POWER-UP, or when all lamps are turned off, or after a fatal fault is received and the option is to turn lamps off after fault. It will not leave this state unless it receives one of the following;

- LampOn command received or auto lamp on
- A request to change into diagnostic state is received

NOT READY, LAMP ON – Detector is not ready for starting a run. It will be in this state after a lamp on and EnableIn is set, and SyncInReady is high. It will not leave this state unless it receives one of the following;

- LampOn command received or auto lamp on (2nd lamp)
- A request to change into diagnostic state is received
- It receives a low on SyncInReady
- A lamp off (or AutoLampOff) is received. (2nd or both lamps off now)

INITIALISING – Calculates Dark table for each gain setting (only if transitioning from no Lamps On to one or more Lamps On).
Warms up the D2 lamp for approximately 10seconds.
Strikes the D2 lamp.

MONITOR – A post-setup autozero and collection, of the noise level required by the user/host for peak sense. A message interface command through user software is needed to disable the monitor data collection (does not disable any AutoZeros or other parts of the monitor).

This data collection is separate from the method collect data as it is a fixed time length. When data is collected, the detector will calculate relevant Peak Sense control information.

READY – Detector is now usable. Once the detector receives a START IN, or command "Start" it will progress to RUNNING state.

RUNNING – Method is currently being run and the method clock is on.

STOPPED – Method clock has been stopped and the run method can be restarted through START IN or method "Start" command, or a reset with the Reset command.

DIAGNOSTIC – This is a special state that allows some actions to happen out of sequence or without certain pre-requisites being met, i.e. can start collecting data when no lamps are on for instance.
In this state the detector cannot perform data collection. It is intended for faultfinding purposes only.
It will only exit this state when a Diagnostic command to exit Diagnostics state is received.

POWER ON – This state is the initial power up. Detector is loading up its internal systems before it begins its start up phase. It loads the FPGA, checks the hardware and configuration. During this state all user intervention is disabled.

Shown below is a table of detector states and the status of SYNC signals for each state;

Detector State	SYNC signal outputs				SYNC signal inputs				
	Enable Out	Ready Out	Start Out	Fault Out	Enable In (Software switch)	Ready In (Enable In active)	Ready In (Enable In not active)	Start In	Fault In
NOT READY LAMP OFF	active	not active	not active	not active	ignore	ignore	ignore	ignore	ignore
NOT READY LAMP ON	active	not active	not active	not active	detect status	detect level	ignore	ignore	ignore
INITIALISE	active	not active	not active	not active	detect status	detect level	ignore	ignore	ignore
MONITOR	active	not active	not active	armed (Pulse)	detect status	detect level	ignore	ignore	detect transition
READY	active	active	not active	armed (Pulse)	detect status	detect level	ignore	detect transition	detect transition
RUNNING	active	not active	Pulse on entry	armed (Pulse)	ignore	ignore	ignore	ignore	detect transition
STOPPED	active	not active	not active	armed (Pulse)	detect status	ignore	ignore	detect transition	detect transition
DIAGNOSTIC	settable	settable	settable	settable	monitor	monitor	monitor	monitor	monitor

3.19 Detector Performance Tests

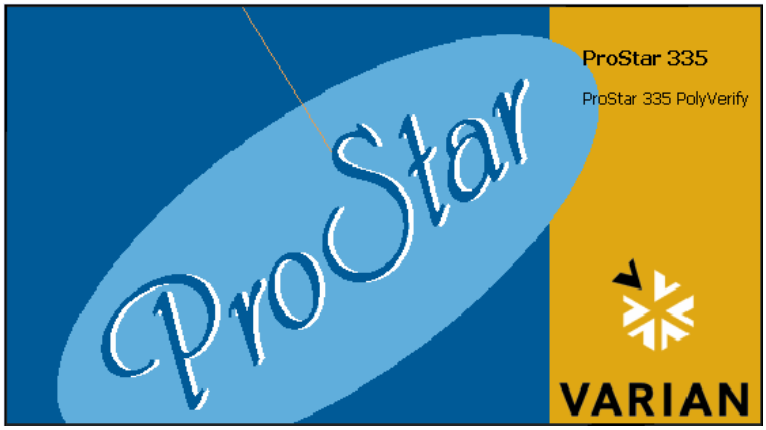
The ProStar335 Verify software application contains the following selection of tests that are used to verify that the detector is performing according to specification;

Cell Length Ratio: determines the ratio of long to short cell path. The user is prompted to pump water and acetone through the system. The cell length ratio is calculated and reported.
Noise: determines the noise performance of the detector in uAU. The short term noise is calculated and reported. The drift of the detector can also be determined simultaneously when the “Drift Test” check box is selected. The result is shown in mAU/hr.
Wavelength Accuracy: determines the wavelength accuracy, in nm, of the detector.
Slit Bandwidth Accuracy (SBW): determines the spectral bandwidth of the detector in nm.
Detector Linearity: determines the detector linearity performance in %T. The user is firstly prompted to firstly pump water through the system, then followed by 10.0%v/v acetone solution.
Refractive Index: determines the detector’s sensitivity to refractive index change in mAU. The user is prompted to alternate pumping water and methanol through the system. The change in baseline is calculated and reported.

Two of these tests, **Noise** and **Wavelength Accuracy**, are used to verify the performance of the detector during installation. The remaining tests form part of the IQ/OQ Validation package which is available separately.

You should compare your results with those obtained at the factory. The results obtained during factory testing are included in the packing crate with the detector.

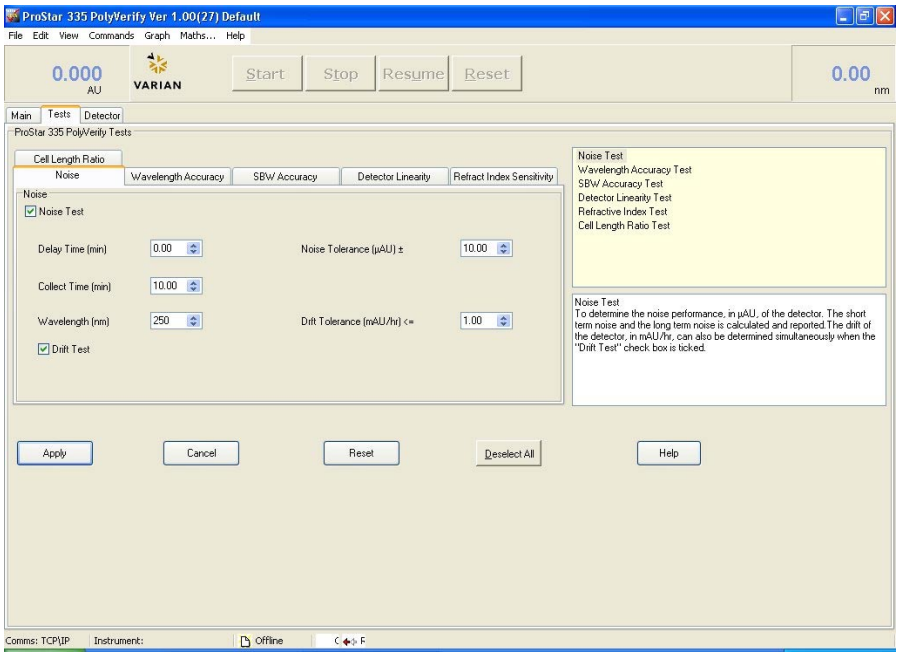
If any of the tests fail to meet the specifications you can refer to the Troubleshooting and Diagnostics Chapter of this manual to help diagnose and correct the problem.



To start the installation tests using the Verify software:

- Click on the Windows “Start” button.
- Point to Programs and select ProStar335 from the flyout menu.
- Select the Verify application from the second flyout menu.
  After the initial ProStar flash screen appears, the Verify application will open.
- Select **Tests** and then select the **Detector Performance Tests** radio button.

The verify software will be automatically loaded with the selected tests.


ProStar 335 PolyVerify Ver 1.00(27) Default
File Edit View Commands Graph Maths... Help
0.000 AU
VARIAN
Start Stop Resume Reset
0.00 nm
Main Tests Detector
ProStar 335 PolyVerify Tests
Cell Length Ratio
Noise
Wavelength Accuracy
SBW Accuracy
Detector Linearity
Refract Index Sensitivity
Noise
Noise Test
Delay Time (min) 0.00
Collect Time (min) 10.00
Wavelength (nm) 250
Drift Test
Noise Tolerance (µAU) ± 10.00
Drift Tolerance (mAU/hr) <= 1.00
Noise Test
Wavelength Accuracy Test
SBW Accuracy Test
Detector Linearity Test
Refractive Index Test
Cell Length Ratio Test
Noise Test
To determine the noise performance, in µAU, of the detector. The short term noise and the long term noise is calculated and reported.The drift of the detector, in mAU/hr, can also be determined simultaneously when the "Drift Test" check box is ticked.
Apply Cancel Reset Deselect All Help
Comms: TCP\IP Instrument: Offline

- Click **OK** to continue.
- Click START to start tests.
- Enter in the customer details and detector serial number and type.

Each test will be run in succession, and the results for each test are displayed in the Report area immediately after the test is completed.
At the end of the Verify run, the ProStar system automatically generates a report file. The report file is stored in the ProStar directory and saved with the following format:

DATE TIME.RVO

For example,
16 Apr 97 3;57;48 PM.RVO

The date and time will appear in the same form that is set in the Windows Regional Settings Properties dialog box that is accessed from the Windows Control Panel.

This feature will aid in keeping a history of the detector's performance.
Print two copies of the Reports page.

- One copy is for the customer
- One is for you to attach to the Installation Service Report.

If you are using these routines to test an detector after the installation date, the reports need not be kept.

3.20 Flowcell

Flowcell bodies are constructed from titanium and are fitted with quartz optics windows. These lenses shape and focus the beams which form an integral part of the detector's optical system.
A pathlength of *a* mm x *b* mm means that the sample light path has a pathlength of *a* mm, and the reference light path has a pathlength of *b* mm. A reference light path of zero means there is no fluid in the cell — air acts as the reference.
The ProStar335 can be fitted with any one of four flowcells (ordered separately). The customer's chosen flowcell type is packed internally in the detector. The four types are;

Part Number	Description	Volume
02 101818 00	FLOWCELL 9x0 ANALYTICAL	15ul
02 101819 00	FLOWCELL 9x1 PREP	30ul
02 101820 00	FLOWCELL 4x0.15 SUPER PREP	15ul
02 101821 00	FLOWCELL 4x0 SEMI MICRO	1.6ul

All flowcells can be removed and re-installed as follows:

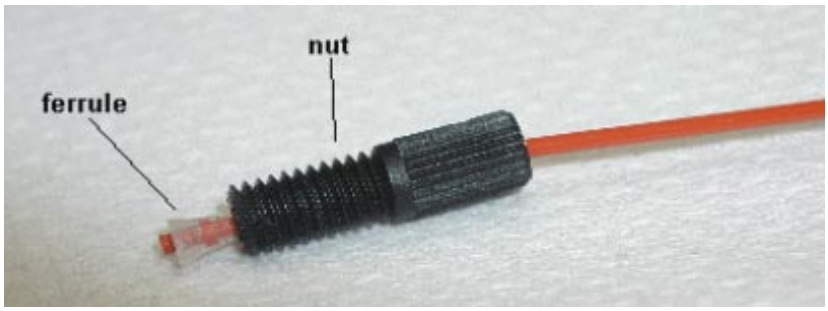
- The flowcell should be removed with the connecting tubing fitted. These must be removed outside the detector compartment.
- Access the flowcell compartment by removing the green front door.
- Remove the flat panel by loosening the single screw on the top left hand corner.
- Loosen the two thumbscrews which secure the flowcell.
- Holding the flowcell by these two thumbscrews, carefully remove it from its position.
- The replacement procedure is the opposite of this. Use care to align the flowcell on locating pins. Carefully seat the flowcell so that the two thumbscrews are positioned in the locating holes inside the flowcell compartment. Push at the centre of the flowcell to ensure it is positioned squarely in its housing. It must not be tilted in any way so that it clips or distorts either of the two beams coming from the light source. This will have an adverse effect on the detectors performance.

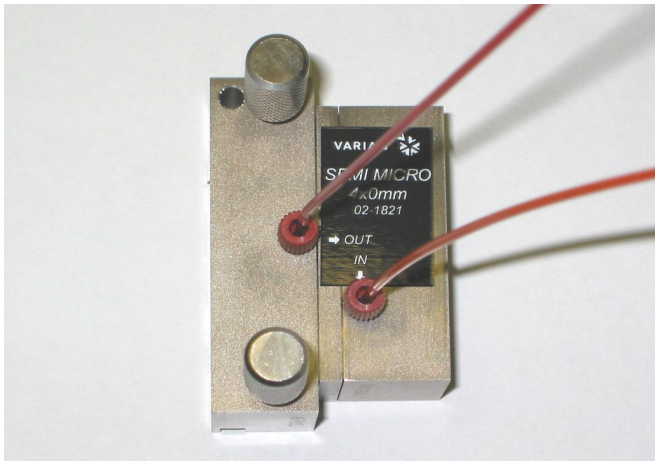
3.20.1 Tubing

Each flowcell comes with a set of nuts and ferrules that are fitted to PEEK tubing and are connected to the flowcell's inlet and outlet ports.
Screw these two tubes into the body of the flowcell. Do not over tighten as this will damage the threads. Each flowcell has an inlet and outlet connection.

Tubing connections are PEEK type except for the Super Prep flowcell which uses Tefzel Tube 0.125 x 0.062.

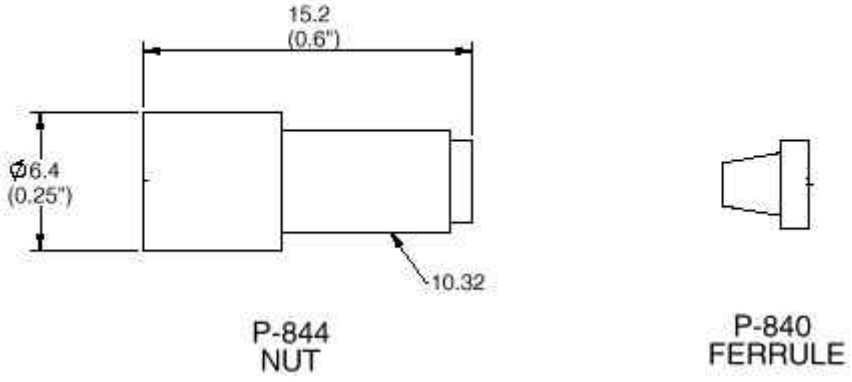
	Part number	Description
Used on all types except 4x0.15	16 101265 00	Fitting 1/16 tube nut/ferrule flat bottom (Pack of 10)
Used on flowcell 4x0.15 only	16 101269 00 16 101264 00	Fitting 1/8 tube nut flat bottom (each) Fitting 1/8 tube ferrule (Pack of 10)





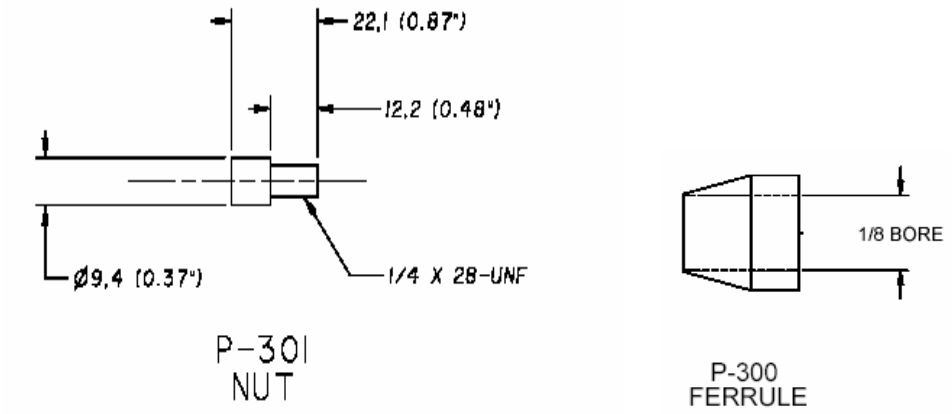
Flowcell showing thumbscrews and inlet and outlet connections. A 9 x 0 type flowcell is shown. The position of the inlet and outlet connections varies for different flowcells.

Fitting 1/16 tube nut - ferrule, flat bottom



Vacutight - 1/16 tube short
headless, nut 10.32 with ferrule

Fitting 1/8 tube ferrule, flat bottom



3.20.2 Flowcell storage

Prior to storage, flush out the flowcell with methanol or isopropyl alcohol (IPA). Leave the solvent inside the flowcell during storage by connecting a short length of tube between the inlet and outlet connections of the flowcell. To avoid possible degradation in performance due to dust, store flowcells in sealed plastic bags whenever the flowcell is not installed in the detector. Whenever the flowcell is removed, set the flowcell with the faceplate upward and avoid touching the inside of the flowcell recess. Cover the flowcell opening with a piece of 3cm x 5cm card, or always place a flowcell in the flowcell opening.

3.20.3 Cleaning the flowcell

The high sensitivity of the detector and the low volume of the flowcell make it imperative that a high standard of solvent purity and general system cleanliness be maintained. A contaminated flowcell can lead to noise and drift problems that are often mistakenly attributed to other areas of the system.

The cell can be cleaned in-situ (in place) quite successfully by using the following procedure;

1. Flush the system thoroughly with HPLC grade water to remove any trace of organic solvents.
2. After the system has been rinsed with water, pump 25% phosphoric acid through the flowcell. This acid is prepared by diluting one part of concentrated phosphoric acid with three parts of HPLC grade water.
3. After pumping 50mL of the 25% acid through the cell at 1-2 mL/min, rinse by pumping 100 to 200mL of HPLC grade water through the system. Do not allow the acid to remain in the cell for more than one hour. Dispose of the acid in accordance with approved waste disposal procedures.
4. Do a final rinse with acetonitrile or methanol.

The frequency for cell cleaning depends upon the cleanliness maintained during routine operation.

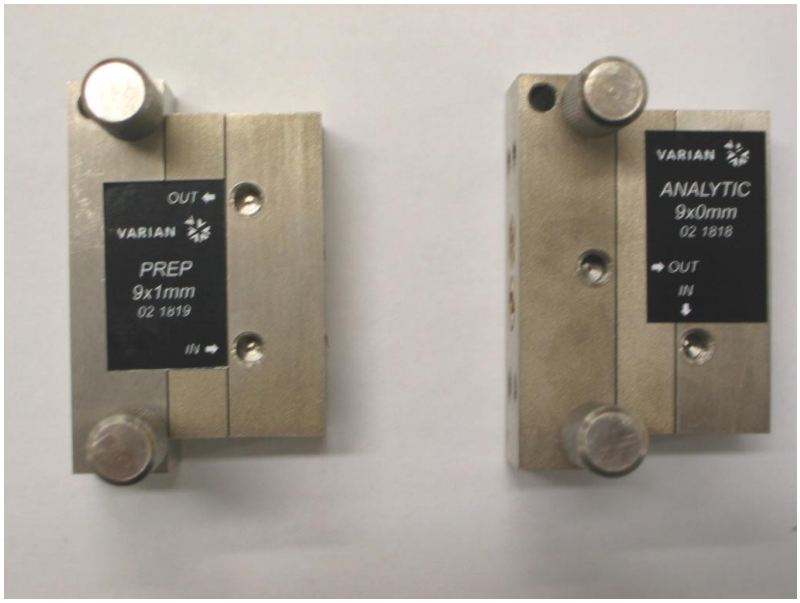
When making or breaking solvent line fittings, care should be taken to prevent any contamination of exposed fittings. Tubing should be sealed or capped when not actually connected. Thread lubricants should never be applied to compression fittings.

The external windows of the flowcell can be cleaned with a dry, clean source of compressed air or nitrogen. Remove the flowcell and carefully blow any dust or contamination from the external windows. Replace the flowcell, ensuring that the sample and reference beam windows are not obstructed.

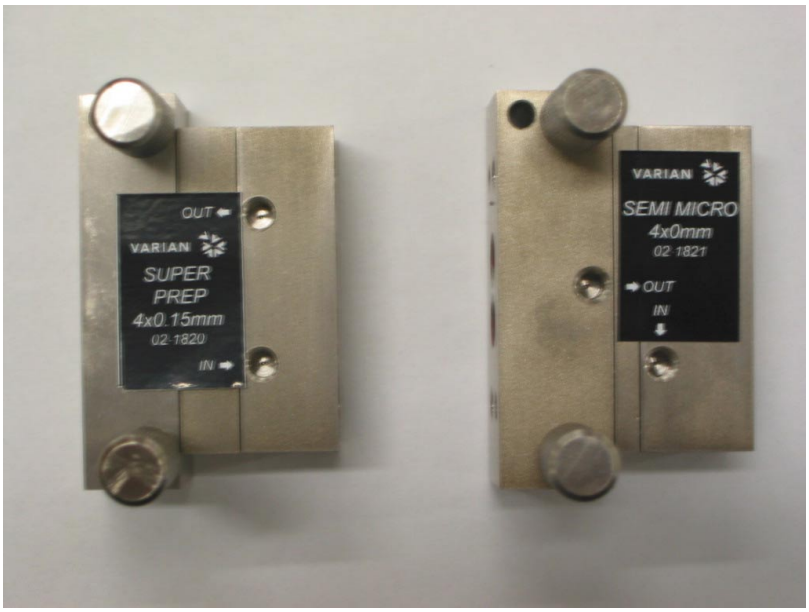
Publication date: April 2004

3.20.4 Flowcell types

There are four flowcell varieties available for the ProStar335 detector. Each one has an inlet and outlet connection, quartz optics cell window and each type is easily identifiable.



9x1 Prep *9x0 Analytical*



4x0.15 Super Prep *4x0 Micro*

3.21 Back pressure restrictor

The outlet port of the analytical and semi micro flowcells should be connected to a back pressure restrictor (provided in the ship kit). Also, the preparation 9x1 prep flowcell should also be connected to a back pressure restrictor when it is used for analytical measurements.
The back pressure restrictor provides approximately 40psi back pressure on the flowcell. This prevents outgassing and bubbles from forming or being trapped in the flowcell, which can cause an unstable baseline.

Note that the arrow that is stamped on the restrictor body must point away from the flowcell outlet port, and toward the waste receiver. The threaded plastic fittings should be finger tightened only enough to prevent leaks.

Some 1/16" tubing is supplied at both the inlet and outlet of the restrictor. The inlet tubing is provided with a 1/16" plastic fitting for connecting to the flowcell outlet port. Either the outlet tubing can be directed to the waste container, or the tubing removed, and the restrictor itself dropped to the bottom of the waste bottle.

The pressure of the restrictor is not adjustable. If it fails or becomes blocked it will need replacing (p/n 01-107433-00).

3.22 Extended range

The ProStar335 detector can extend the working absorbance range by calibrating the path length ratio between the long and short path cells.

Extended range calculations are standard with all detectors.

For cell configurations that do not support dual path operations, an error will be reported based upon the cell ratio calculated to be above 100. In this case the extended range option will be automatically disabled.

The extended range ratio is set in the workstation software. It can be found listed on the flowcell. The exact ratio shown on the flowcell should always be used.

3.23 Source lamps

All ProStar335 detectors come with the source lamps pre-aligned from the factory so there is no alignment necessary.
Instructions on how to change both the visible and UV lamps in the detector are included in the Optics section of this manual.

A new UV replacement lamp is delivered tested and pre-aligned on a mounting bracket. It is designed for direct exchange installation, and requires no alignment after it has been installed.

Follow the steps given in the Optics section of this manual for removal of the old lamp, and installation of the new one.

After replacing the deuterium source lamp, a calibration will be required. Please refer to the Electronics section for details.

For both lamps the following safety precautions should be observed:

Warning
Lamp surfaces and mounting brackets will become hot during operation and will remain hot for some time after being switched off.
The temperatures are sufficient to cause burns.
The UV lamp operates at high voltage. Contact with this voltage can cause death, serious injury, or painful electric shock.
Before changing either the UV or visible lamps, always switch the detector off, remove the power supply cable and allow the lamps to cool.

Caution
Care must also be taken when removing lamps. Touching the glass envelope of either the UV or visible lamp will reduce its efficiency.
Never touch the glass surfaces of new lamps.
Always handle a lamp by its base.

Publication date: April 2004

3.24 Cleaning

Any spills should be wiped up immediately, and any deposits on the windows should also be removed.

The exterior surfaces of the ProStar335 detector should be kept clean. All cleaning should be done with a soft cloth. If necessary, this cloth can be dampened with water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

3.25 Excessive Noise and/or Drift

Excessive noise and/or drift have two primary sources: a contaminated or leaking flowcell or a worn out deuterium lamp. To determine the source of the noise and/or drift, pump HPLC grade water through the flow cell at 1mL/min directly from the pump with no column in the system. Set the detector wavelength to 240 nm and a time constant of two seconds. Adjust the recorder attenuation to 0.001 AUFS. Record 10 to 15 minutes of detector output at a chart speed of 1cm/min. Now stop the pump and continue to record detector output. NOTE: It may be necessary to autozero initially to keep the trace on the chart paper.
If the noise and/or drift problem disappears after stopping the pump, the source is flow related and the flow cell is the cause. If the noise and/or drift problem is still present after stopping the pump, it is not flow related and the deuterium lamp is the source.

If the flow cell is the problem, clean it using the procedure given in this section. If the cleaning procedure does not rectify the problem it will be necessary to replace the flowcell assembly (see Optics section).
If the deuterium lamp is the problem source it must be replaced with a new lamp (Optics section).

If you suspect that the deuterium lamp is the source of the noise and/or drift problem, check the elapsed lamp hours and lamp intensity. Compare these values with those you have previously recorded.

VARIAN

INSTALLATION ACCEPTANCE CHECKLIST

☐ GC ☐ HPLC ☐ GC/MS ☐ LC/MS ☐ DH ☐ Options/Accessories

SYSTEM IDENTIFICATION

CUSTOMER NAME		OPERATOR NAME	
PHONE	EMAIL		S.O. #
COMPANY NAME AND ADDRESS		DETECTOR MODEL #	DETECTOR SERIAL #
CUSTOMER SUPPORT REPRESENTATIVE		DATE INSTALLATION STARTED	DATE INSTALLATION COMPLETED

SETUP AND INSTALLATION

REFER TO THE OPERATION OR INSTALLATION MANUAL FOR DETAILED INSTALLATION PROCEDURES.

Other options/accessories installed? ☐ Yes ☐ No

If yes, complete and attach the Options/Accessories Installation Acceptance Checklist.

LIST MISSING ITEMS AND SHIPPING DAMAGE TO DETECTOR OR PACKAGING:			
CSR INITIAL	DATE	CUSTOMER INITIAL	DATE

DETECTOR VERIFICATION

☐ All installation performance tasks successfully completed.

COMMENTS:

OPERATIONAL FAMILIARIZATION

☐ Basic Operation	☐ Recommended Spare Parts	☐ Warranty Coverage Explained
☐ Maintenance Procedures	☐ Recommended Operating Supplies	☐ Service Contract Availability
☐ How to Contact Service & Support	☐ Availability of Training Courses	☐ _____

CUSTOMER ACCEPTANCE

_____ confirms that the _____ have been accepted, are subject to applicable warranty provisions, and that final payment for them is now due.

CSR SIGNATURE	DATE	CUSTOMER SIGNATURE	DATE

INSTALLATION TIME Labor Hours: _____ Travel Hours: _____

Publication date: April 2004

4 Electronics

4.1 Introduction

The electronics system in the ProStar 335 detector provides the interface to the optical measurement system, including any accessories. Communications is through an external host computer running as a Star or Galaxie workstation connected via Ethernet. The detector electronics control all necessary parameters of the optical system to enable a photometric reading to be made at a specified wavelength. Results are then transmitted to the host computer for analysis.

The power supplies for the detector are delivered from two main OEM power modules and from the main Processor PWB. All processing of digital and analog signals (including accessory signals) are also handled by this PWB

Mains supply for the detector enters through a Corcom filter network and varistor combination, which help to suppress transient disturbances. Overcurrent protection fuses 1FS1 and 1FS2 are mounted on the rear panel. The fuses are T3.15AH250V and are contained in the input module.

The two OEM supplies are universal mains switchmode supplies with an input range of 85 – 264VAC at 50–60Hz +/-1Hz.

4.2 OEM power supplies

The two main power supplies in the detector supply the following voltages;

Power Supply #1: +24V, 65W

Power Supply #2: +5V, +/-12V, 40W

4.2.1 Low voltage power supplies

The +24V power supply is used to feed the switch mode supply circuits for the two lamps and supply the slit drive motor circuit.

The +5V supply is used to generate the +2.5V and +3.3V necessary for all the digital logic circuits.

The +12V and -12V are used to generate the +9V and -9V used for the analog circuit supply.

The Processor PWB assembly contains a number of independent power supply circuits for regulating the voltage supplies needed by the detector. Most of these supplies use linear regulators. Consequently the Processor PWB only requires low voltage input supplies for producing all the necessary voltages.
The supplies for the D2 and visible source lamps use switch mode regulation techniques for supplying their respective lamps.

Linear regulators

U52, U53, U54 and U55 provide the necessary dc voltages to the rest of the Processor board.

4.2.2 Deuterium (D_2) lamp power supply

The deuterium lamp supply provides power for the filament and the arc in the lamp. It allows the flexibility of maintaining some filament drive when the arc is struck. It consists of a current limit foldback circuit and a current source. The sequence of operation to start the lamp is: Assert D2FILON# (this turns on the filament supply at full voltage and the arc supply with the current source turned off), Wait 10 seconds for the filament to warm up, assert D2ON. During the warmup time the arc supply is charging C226 to approximately 475V to provide the strike voltage. When D2ON is asserted the current source transistor, Q8, turns on and tries to sink 300mA. This places 475V across the lamp via R194 and R241. The lamp starts conducting and is carried into the negative resistance region by the current from C226. The voltage on the anode drops below the voltage on D14 anode and the current starts to flow from the run supply. The current builds up to 300mA and the current source starts to regulate causing the voltage on Q8 drain to go up and the controller to reduce the pulse width due to the action of D15.

Filament supply

The filament supply is an isolated flyback converter running at approximately 220 kHz. Feedback is provided by the network from D24 to R219 which senses the voltage pulse on the primary reflected from the secondary. R221 changes the output voltage for warmup and run modes of operation. D22 turns off the filament supply when D2FILON is negated. D23 is a snubber to reduce the spike on the transformer primary due to leakage inductance of the transformer. U43 senses the average voltage on R226 and outputs D2FILOK# to the processor board when it is above a threshold.

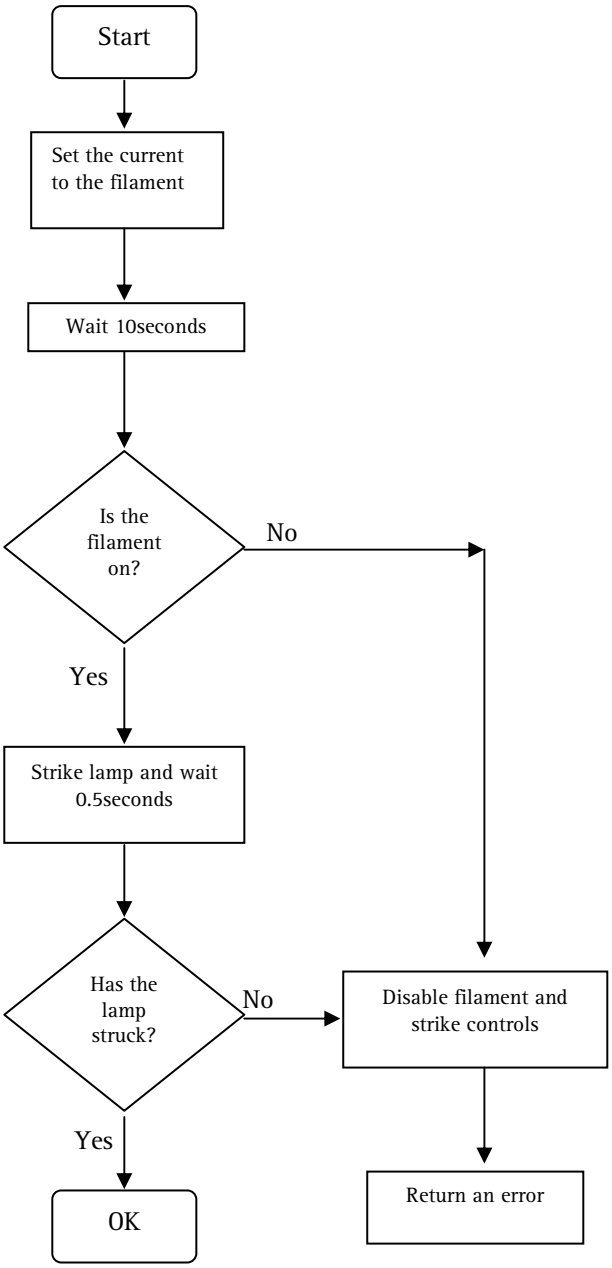
Arc supply

The arc supply is a discontinuous current boost converter with an extra tap on the transformer running at 180kHz. It has 2 modes of operation. During filament warmup it operates with Q8 off and generates 475V on D2ANODE and the filament terminals can float up to a high voltage so the arc is not started. During run mode Q8 is regulating the current and the voltage feedback is from the D_2 lamp's cathode via D15.

Warning If the polycarbonate safety cover is removed, the D_2 supply voltage is exposed. Contact with this voltage may cause electric shock or death. Minimize this risk by keeping the cover in place.

Publication date: April 2004

The following is the sequence of events when the D_2 lamp is striking;



4.2.3 Visible lamp power supply

The visible lamp supply is a continuous current buck converter operating at 200kHz. One side of the lamp is connected to +24V and the other side is regulated to be 12V down from that supply. U56 is a current mode controller. Q10 is turned on by the controller, causing the current in L5 to increase. Q10 is turned off by either a maximum current (as sensed at pin 3 across shunt R352), or a voltage over 2.5 volts on pin 2. When Q10 switches off, the flyback spike is clamped to +24V by D39.

U45 is a differential amplifier that provides the correct feedback voltage to U56. This results in a lamp voltage of 12.1 VDC.

Diode D40 couples the VISON# signal to the feedback pin (U56 pin 2) to force the device to the off state when VISON# is not asserted.

U46 compares the average current in shunt R352 to a fixed reference. This is used to report that filament current is flowing (lamp lit).

4.3 Processor PWB

The Processor PWB contains all necessary photometric signal processing and I/O devices to control the detector and any accessories.

Operating conditions and results are transferred between the detector and host computer by an Ethernet TCP/IP interface. The computer has ultimate control over the system and is responsible for issuing commands to the detector and accessories. The detector interprets these commands, carries out the required actions, and reports the results.

The Processor PWB is a fibreglass board with eight layers of tracks and power planes, using surface-mount technology (SMT). Component-level repair is generally not possible and is not recommended.

If you have a need to attempt to unsolder/solder components, use caution as damage to any of the through-holes ("vias") would be very difficult to repair.

There are SMT components on the rear of the board that may be damaged if they catch on objects when the board is being handled.

Electro-magnetic compliance (EMC) issues

The use of an eight-layer PWB ensures that radiation from the printed tracks is reduced, because the tracks act as microstrip transmission lines relative to the contiguous groundplane.

Small ferrites have been fitted to many signal lines that leave the Processor PWB. These inductive devices and the capacitance on the lines filter out higher frequency components, reducing emission of offending radio frequency spectra. Ferrites on input lines also improve input noise reduction and immunity from external interference.

To reduce edge transition speeds (and subsequent radiated noise levels) on the digital lines, the slew rate and drive currents on the Field Programmable Gate arrays have been set to the minimum required for the design to work properly.

4.3.1 Processor PWB functions

The Processor PWB is based on a 32-bit microcontroller type AMD Elan SC520, 133MHz with 1MByte field upgradeable flash memory. Also on board is 16MByte of SDRAM. Software contained in the flash memory gives the microprocessor multitasking capabilities which enable a number of operations to be carried out simultaneously.

A thumbwheel switch and two seven-segment displays are provided for diagnostic control and reporting.

These tasks are executed by the processor PWB -

Photometric signal measurement

Data buffering

Timing control for MUX, ADC and preamp integrators

Source lamp selection and control

Ethernet TCP/IP communications

Real time synchronization of dual channel analog outputs

Service diagnostic tests

Programmable Sync I/O signals

Controls four programmable relays & peak sense relay

Display detector status through front panel dual colored LED's

Setting the Programmable Gain Amplifier

Publication date: April 2004

4.3.1.1 Microcontroller

The Processor PWB is controlled by a 32-bit microcontroller U11, clocked at 33MHz by crystal oscillator Y1. It works off 3.3Volts with a core Vcc=2.5V.

The microcontroller is responsible for the following;

ROM/Flash memory/EEPROM control
Clock, Reset and timing signals
JTAG output port
Diagnostic functions
Serial ports, I/O, RS232

The memory is addressed by the 18 address lines from the Central Processing Unit (CPU). Additional “chip select” lines are internally decoded in the microcontroller to address individual blocks of memory. The input/output devices are provided by a Field Programmable Gate Array (FPGA) and are memory-mapped also.

The WR# and RD# lines are used to strobe data to and from the addressed memory or I/O location.

FLASH memory occupies the top of the memory map and contains a boot block, detector firmware, and gateware for the Xilinx FPGAs.

The boot block is written to the Flash memory using the JTAG port (P1). Once installed, the other firmware is loaded via the Ethernet TCP/IP interface.

4.3.1.2 Ethernet TCP/IP interface

Most of the functions of the Ethernet TCP/IP interface are provided by an Ethernet Controller integrated circuit U12 operating at 33MHz. It contains all the necessary buffers and handshake logic needed to correctly interface with this data transmission protocol through the Microcontroller IC U1.

The microcontroller has a 3.3V PCI bus interface which is compatible with the 3.3V I/O from the Ethernet Controller chip.

4.3.1.3 JTAG port

The Processor PWB is equipped with a JTAG accessible through connector P5. It serially connects to the Microcontroller CPU and FPGA. This gives any device connected to the port access to all the digital lines on these devices. It effectively makes a long (hundreds of bits) serial shift register with one bit at each digital line on the two devices. Values can be shifted into this register to force levels on the device pins, and values can be read back from the pins also.

The JTAG port loads the operating code into FLASH memory. Any further updates of the operating code is done later through the Ethernet interface. The JTAG port can also test RAM and processor bus integrity without having the Microcontroller running.

4.3.1.4 Field-Programmable Gate Array (FPGA)

The Processor PWB contains a FPGA Xilinx U11 which is used to provide the I/O ports for the microcontroller and also to generate some other logic timing required in the detector. This device has the equivalent of 50,000 logic gates that can be configured and connected as needed.

When the detector is powered up, the outputs of the Xilinx are all open circuit and have weak pullup resistors. The Xilinx need to be configured by downloading them with code called “Gateware”. When the microcontroller starts its boot sequence, it downloads the gateware along serial port lines.

Xilinx (U11) sits directly on the microcontroller bus and Its functions include -

Data transmission to/from Microcontroller

ADC/DAC timing, control, and accessing

Diagnostics functions

Front panel LED's

Back panel I/O signals

Timing signals

Grating motor drive

ADC is accessed through the Xilinx. A read from the ADC will present the data onto the processor data bus. Signal processing in the firmware is interrupt-driven. On completion of a conversion, the ADC causes a signal interrupt (i.e. fresh data is ready to read).

Lamp control and reporting source lamp supplies are turned on or off by the Xilinx according to user requirements. A logic low on either the D_2 ON or VIS ON signals enables the respective supply, although the D_2 lamp also requires a warm up period prior to striking hence the need for the D_2 WARM UP signal. VIS FILAMENT and D_2 ARC signals feed information back to the processor to inform of any possible lamp failures.
Digital I/O for various internal and external signals is done by a simple port on the Xilinx.

4.3.2 Non Volatile Data Storage

The detector stores the following data in non-volatile memory (EEPROM and/or flash memory).This information is retained when the detector is powered off.

The storage is in two sections, CMOS (battery backed) and EEPROM.

4.3.2.1 CMOS

- Lamp(s) hours of "on time", resolution at least 0.1 hours
- Date lamp(s) last changed
- Dual path flow cell ratio and type
- Equipment name / Detector alias

The contents of the CMOS can be read and changed through user software interface and the Diagnostics application.

The battery must be replaced with the mains power on in order that the CMOS memory is not lost.

4.3.2.2 EEPROM

TheEEPROMcontains the following information;

- Detector serial number
- MAC address
- Wavelength calibration factors, slope and offset
- IP address
- Gateway address
- Subnet mask
- Lamp timer (on/off date and times)
- Detector installation date
- Last maintenance date
- Error log
- Hg wavelength calibration date

The contents of the EEPROM can be read and changed through user software interface or by invoking the appropriate test through the diagnostics thumbwheel selector switch (refer this chapter and Diagnostics).

4.3.3 Signal processing and A to D conversion

Output signals from the Dual Photodiode Pre-amp PWB are fed into the ANALOG INPUT circuitry. This circuit then performs a number of functions;

Multiplexing between the two channels
buffering
level shifting
amplification

The signals are then sampled and held in preparation for the 16-bit A/D conversion to take place.

4.3.4 Relay Outputs

There are 4 general purpose output relays and one dedicated peak sense relay. Each output uses a DIP relay that is capable of handling 500mA of contact current.
At reset or power up, the output relay contacts are set to the default parameters. After loading a method they will be set as defined in the methods T_0 parameters.
The peak sense relay is software programmable for duration, delay and active sense. At power up the relay contact will be set to the inactive state (as defined by the value of the “active sense” parameter stored in the detector). Upon being triggered, relay activation will occur at the time interval equal to the “peak sense duration” parameter as stored in the method.
The peak sense relay can be activated from any of the following sources (only one source can be active at any one time).

Peak Sense event – any of the peak sense events (start peak, end peak, or peak valley) will activate the relay.

Level Sense event – The relay will be activated whenever the absorbance value crosses over the absorbance threshold which is set by the user in the method.

Time slice event – Once timeslice has been turned on, it will provide a periodic activation of the peak sense relay at an interval defined in “TimeSlice period” within the method. Time slice can be turned on and off from either runtime, peak sense, or level sense.

Pulse event – Run timed programmed activation of the peak sense relay as defined in the method.

4.3.5 Peak Sensing

The detector is able to perform peak sensing functions on the data in real time. The purpose of the peak sensing function is to control a fraction collector via the peak sensing relay.
The peak sensing functions will trigger the following events;

The start or end of a peak

A valley point

These events will either trigger the peak sense relay directly or start a time slice function depending on the current method definition. It will also mark the selected analog output with tick marks.
Peak sense is applied after all data calculations, and before bunching.
Peak sense does not account for filter delays. These are a user responsibility in the method (relates to tube lengths).

4.3.6 Analog Output

Both of the analog outputs are for connection to a chart recorder. This is particularly useful with the dual wavelength option so you can monitor both channels. The parameters that can be modified on the output include the AU represented by full scale deflection.

Tick marks are short positive and negative (up and down) spikes generated at the recorder output that are used as event marks for points of interest. Tick marks on the recorder output are about 0.5s in duration to give comparable height on all chart recorders. Tick marks occur at the following peak events:

- Inject (method start) – positive spike (up)
- Peak Start – positive (up)
- Peak Valley – negative (down)
- Peak End – positive (up)
- Pulse – negative (down)
- Time Slice – positive (up)
- Level - positive (up)

A tick mark will appear at the analog output in real time immediately after the event is detected, whereas peak sense relay activation will occur only after the time interval of the “peak sense duration” parameter.

The analog output is driven by a 16-bit converter with an output range of 0-1V FS with +11%/-20% over-range.
This gives an analog output resolution (at 1 absorbance = 1 volt) = 1V*131% / 65535 = 20uV = an absorbance of $2x10^{-5}$.

The Full Scale ranges are:

Full Scale (absorbance)	*Resolution (absorbance x10^6)*
0.0005	0.01
0.001	0.02
0.002	0.04
0.005	0.1
0.01	0.2
0.02	0.4
0.05	1.0
0.1	2.0
0.2	4.0
0.5	10.0
1.0	20.0
2.0	40.0
5.0	100.0
10.0	200.0
20.0	400.0
50.0	1000.0
100.0	2000.0

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4.3.7 Calibration

The electronics on the Processor PWB do not require any manual calibration. The detector does however perform other self-calibrations.

4.3.7.1 Lamp Calibration/0%T

A lamp calibration allows the maximum gain setting to be used for each slit width and is applied across the entire wavelength range. This calibration routine relates to the photometric signal level present at the output of the signal amplifier circuit. There is only one gain setting used for the entire wavelength range. The detector captures each spectrum and sets an electronic gain that will correspond to 80% full-scale deflection on the ADC circuit. The gain versus wavelength information is calculated during a Lamp Calibration and is stored in non-volatile memory. This information is retrieved from non-volatile memory during detector initialization. Also, during initialization a deuterium lamp line is measured and used in wavelength drift compensation.

Performing a calibration:

The ProStar335 must be allowed a one hour warm up period before calibrating. This will ensure optimum linear correction is achieved.

It is crucial that the flowcell is seated installed and is positioned in a way where neither of the two beams passing through it are clipped or distorted.
Pump clean water at a rate of 0.2 to 1.0 ml/minute with a backpressure of 40psi. This will help clear the flowcell of bubbles.

When to calibrate:

A lamp calibration helps to minimize noise and improves linearity by re-balancing the 0%T values. This becomes a factor with ageing lamps
A lamp calibration is required when;

- deuterium lamp is changed
- visible lamp is changed
- when changing the flowcell to one of a different path length
- every 1000 deuterium lamp hours
- every 1000 visible lamp hours
- increasing signal noise

Symptoms of poor calibration can be;

- signal readings are overranged
- no response to changes in absorbance
- signal noise is either very high or zero

Poor calibration can be a result of bubbles present in the flowcell while the calibration was in progress. Under this circumstance, the gain settings will be too high to cope with when the flowcell is full of water.
A flowcell must be seated correctly when a lamp calibration is performed. If not, then the detector will display the symptoms described above.
Calibration on an ageing lamp that has a low light throughput will also result in high gain calibrations.
High gain settings may show chromatograms with peaks that are cut off at the bottom.

4.3.7.2 Wavelength Calibration

Each ProStar 335 detector comes calibrated from the factory. A wavelength calibration is performed using a mercury lamp source. The calibration coefficients are stored within the EEPROM. Wavelength accuracy is constantly maintained by firmware routines executed during normal operation of the detector. A “lamp on” or “Start” function for example will trigger such an event where the following firmware routine is performed;

- find 656.1nm deuterium emission line
- derive a calibration coefficient
- Store the coefficient into EEPROM

This wavelength calibration coefficient is applied to firmware routines during normal operation of the detector and is used to prevent wavelength drift. It can be identified in the EEPROM contents as “Drift Coeff E”.

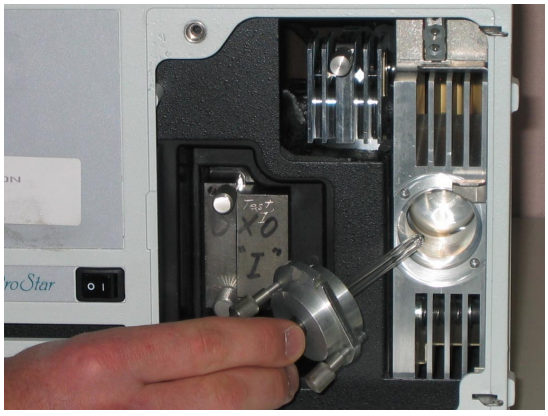
Once calibrated, a re-calibration of the ProStar 335detector using the mercury lamp is unlikely.

For single array configurations, the reference utilizes a pair of photodiodes centred on 250 and 600nm. If only the D2 lamp is on, the 250nm diode is used as a reference for the whole wavelength range. If only the Vis lamp is on, the 600nm diode is used over the whole range. If both are on, then the 250nm diode references all wavelengths below 400nm, and the 600nm diode references all wavelengths above 400nm. There is a 100 nm ”blend region” around 400 nm to reduce spectral artifacts induced by slow wavelength drifts.

4.3.7.3 Wavelength calibration procedure using Hg lamp

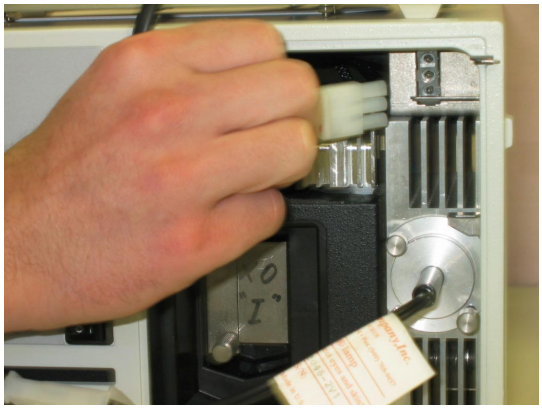
To perform a wavelength calibration on the ProStar335 you will require the use of the Hg lamp test box. The Hg lamp substitutes the deuterium lamp inside the detector. The test box contains some electronics but essentially derives its power from the deuterium lamp supply circuit.

- Remove the deuterium lamp from the detector and fit the Hg lamp in its place.



Publication date: April 2004

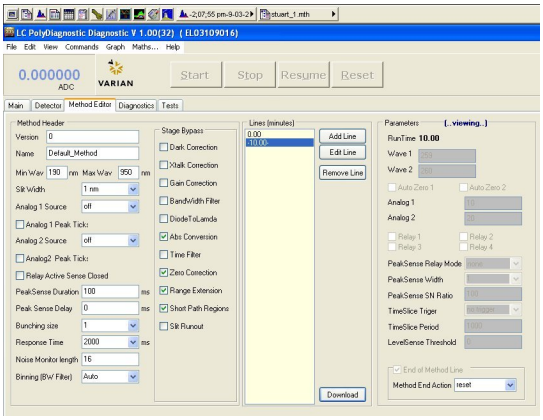
- Connect the flying lead from the test box to the deuterium lamp connector.



- Switch on the detector and establish communications using Diagnostics software.
- Switch the lamp on by clicking “D2 Lamp”.

Once the Hg lamp is on, it is important you allow at least 10minutes for the Hg lamp intensity to stabilize before you commence the calibration. To verify when the lamp has stabilized you can run the following method;

SBW = 1.0nm
Wavelength range = 190nm - 950nm
End of Method = 10min
Stage Bypass, select - Abs Conversion
Zero Correction
Range Extension
Short Path Regions

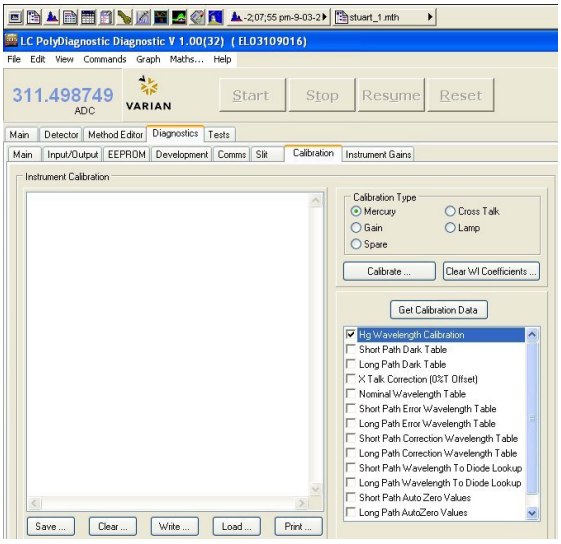


Press “Start” and wait for the trace result to appear on the screen. Wavelength calibration is performed on the following emission lines;

253.652nm - mercury
546.073nm - mercury
912.297nm - argon

The Hg lamp intensity is said to be stable when the intensity of the argon emission line drops below the mercury emission lines. Keep running the method until this happens.
Proceed to the next step when this is achieved.

- Go to Diagnostics>Calibration and select “Mercury” as the calibration type.
- Select “Hg Wavelength Calibration”.



- Select “Clear Wl Coefficients”
- Select “Calibrate”

The graph page will automatically be displayed while the detector is performing a wavelength calibration.

When the calibration is complete, the offsets will be displayed in the “Detector Calibration” text field. They will also be stored in the detector’s EEPROM.

The information in the text field will have the following appearance;

[Header]

Serial Number=EL03109016

MacAddress=006093F001DF

Detector Name=EL03109016

Date=10/03/2004 3:56:55 PM

[Hg Calibration Coefficients]

LongPath Coeff A=0.0000176

LongPath Coeff B=0.00616

LongPath Coeff C=-9.77

LongPath 1nm Coeff D=2.29

LongPath 2nm Coeff D=3.11

LongPath 4nm Coeff D=1.60

LongPath 8nm Coeff D=1.86

LongPath 16nm Coeff D=-0.77

LongPath Open Coeff D=-1.37

LongPath Drift Coeff E=0.00

ShortPath Coeff A=0.0000000

ShortPath Coeff B=0.00000

ShortPath Coeff C=0.00

ShortPath 1nm Coeff D=0.00

ShortPath 2nm Coeff D=0.00

ShortPath 4nm Coeff D=0.00

ShortPath 8nm Coeff D=0.00

ShortPath 16nm Coeff D=0.00

ShortPath Open Coeff D=0.00

ShortPath Drift Coeff E=0.00

The coefficients used for wavelength offset & slope are; A, B & C.

"D" coefficients are related to slit runout which is performed on the Hg emission line 253.656nm. It does one for each slit position 1nm, 2nm, 4nm, 8nm and 16nm.

"E" coefficients are a wavelength drift correction performed at every "Lamp On" instruction. This number will always be displayed as 0.00 after a Hg calibration.

The ShortPath coefficients will always be displayed as "0.00" for a single array detector. For dual array configurations, there will be numbers displayed in these fields after a Hg calibration.

4.4 Dual Photodiode pre-amp PWB

The Front End electronics is interfaced to the Si Photodiode Linear Arrays and Si Photodiodes using a 16-bit ADC on the Detector Processor PCB assembly (02-101759-00).

The Photodiode Arrays are a N-MOS current output type image sensor with high dynamic range and linearity. They consist of a photosensitive section - a row of 1024 photodiodes (pixels), readout switch section and shift register, integrated into a single chip. Two phase shifted clock streams CLOCK1(pin 2) and CLOCK2 (pin 1), and a START pulse (pin 3) are required for the sensor to operate. When an external START pulse is applied, the shift register generates a train of address pulses to sequentially clock out all 1024 diodes beginning with the first. When one scan for all diodes is completed, an END-OF-SCAN (EOS) pulse (pin 12, negative logic) is output immediately after the last diode is read out. The array uses a charge integration method to read the signal.

Capacitance of the back biased p-n junction of the photodiode is used to collect and store the charge which must initially be pre-charged to a certain potential. This is achieved through a video line bias voltage. During the exposure the light strikes the junction inducing the photocurrent which discharges the capacitance.

The charge required to refill the well of each photodiode is proportional to the product of the incident light and the exposure time (i.e. time between readings of the same diode during the next scan).

For simplicity, the following description of the transimpedance amplifier refers to the Sample channel (Long path) components only but is also applicable to the Reference channel (Short path).

Dual array
A dual stage method is used to handle the signals from the Front End electronics. This results in a pre-amplifier circuit with high precision signal detection, good linearity, and low output noise.
The first stage is the transimpedance amplifier (another name for a current-to-voltage converter) followed by the current integrator stage.
The Front End electronics consist of two transimpedance amplifiers U7,U10, a multiplexer U5, a resettable integrator U8 , an invertor U11, a clamping circuit U12 and an output buffer U13, as well as some auxiliary circuits such as a digital buffer U3, a voltage reference U14, and two active low-pass filters U6A, U6B.

The transimpedance amplifier U7 is a low noise, low bias current opamp that is capable of converting the diode charging current to a voltage at the rate of around 330kHz, i.e. 3.0 us per pixel approximately. The feedback capacitors C9 are used to minimize ringing at the output and optimise settling time. The video line bias voltage of about +2.5V is applied to the non-inverting input of the U7 and to the pin 7 of the PDA. This keeps the output of U7 at this voltage potential above ground.

At each rising edge of CLOCK2 the next diode in sequence becomes available for recharging. A charge equal to that discharged during the integration time is fed from the U7 output through the feedback resistor R25, so that the photodiode is initialised again. Thus at the output of the U7 one can observe short positive polarity pulses with respect to the bias voltage 2.5V.

The two halves of the switch U5 act as a multiplexer to toggle the two channels into the one common path. The Sample channel is connected via a normally closed solid state switch U5B to the input of the current integrator stage. U5A then turns on and the Reference channel is available for processing. The ADC converts these two channels in sequence.

The next stage is the current integrator using the opamp U8. The integration time constant is defined by R36/C15 for the Sample channel and R47/C15 for the Reference channel. The amplified current of each photodiode, in form of a short pulse, is fed from the output of the 1st stage (U7) and being integrated for about 1.5us. To reset the integrator, the switch U4A is closed at the end of the 1.5us. The integrator capacitor C15 starts to discharge through the closed switch and current limiting resistor R37. The “reset” phase will last for 1.5us to discharge C15 completely.

At the output of the integrator we have a negative going boxcar waveform with amplitude proportional to the electric charge consumed by the photodiode while topping the well. The output waveform is still biased at 2.5V above ground.

The purpose of unity gain inverting stage U11 is to invert the incoming signal and make the boxcar waveform go positive. It also inverts the pedestal +2.5V of the waveform to -2.5V.

The clamping circuit consists of a capacitor C33 and a switching element U12. The clamping circuit holds the output potential at ground level by turning ON the clamp switch U12 during the “reset” phase. At the same time the clamping capacitor tracks the incoming signal, which is a composite of sources such as the offset voltage of the array, offset voltage of the subsequent amplifier stages and the video line bias voltage. The switch turns OFF just prior to the end of the “reset” phase. Thus the voltage stored on C33 is subtracted from the signal produced by the next photodiode and removing the voltage of -2.5V from the output signal. It also reduces greatly the impact of the array and amplifiers drift and the noise of the video line bias voltage.

The voltage follower opamp U13 buffers the clamp circuitry and drives the output cable.

The two halves of the digital buffer U3 provide an interface between the incoming 3.3V TTL signals from FPGA and 5V array logic and switches. It is also the output driver for the EOS signal.

The voltage reference U14 provides a low drift, low noise +5VREF voltage (TP12) with low-pass filtering at U6A , which is used as a power supply voltage (TP17) for noise sensitive switching components such as U3, U4 and U5. After being divided at R28, R29 and filtered at U6B, this voltage is also used for generating of the video line bias voltage of +2.5V (TP6).

Single array

Another version of the Front End consists of one PDA amplifier in the Sample channel and two Si photodiode (PD) amplifiers in the Reference channel. The Sample channel (U7, U8, U11, U12, and U13) and auxiliary circuit operate exactly as described in a previous section.

The Reference channel consists of two transimpedance amplifiers U15A, U15B, an analog switch U9 and a buffer U10.

The analog switch U19 of the main PCB (02-101759-00) is used to select between Sample and Reference channels in this case.

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4.5 Initialization Sequence

The electronics system goes through the following routine when it is initialising;

Initialise all ports, interrupts & PCI bus

Test on-board SDRAM

Self check CRC of boot block

Check CRC of flash memory main code

Clear relay outputs and SYNC signal outputs

Check the position of the diagnostic rotary switch and perform the test

Perform normal start up checks

Perform power supply check

Activate READY_OUT SYNC signal

4.6 LEDs and diagnostic display

The Processor PWB is fitted with various LEDs to indicate functions and provide diagnostic information to CSRs.

Under normal circumstances four green LEDs should be lit -

LED5 +5V OK

LED6 +9V OK

LED7 -9V OK

LED8 +24V OK

CPU reset status indicated by a red LED

LED1 Reset line is active (processor halted)

Ethernet communications is indicated by a green LED

LED4 Flashing during communications

4.6.1 Seven segment displays

There are two seven segment displays LED 2 & 3 which provide the status of firmware and fault indication which varies according to the detector status. During initialisation, the following numbers will appear on the two seven-segment displays;

LED 3	LED2
0	0
0	2
0	4
0	5
1	0
1	1
1	2
1	3

They also provide a visual indication of the digital supply lines.

LED 2 Decimal point, +3.3volts

LED 3 Decimal point, +2.5volts

4.6.2 Diagnostic select switch

A 16-position thumbwheel switch is used to select service diagnostic routines.

#	DESCRIPTION
0	NORMAL DETECTOR OPERATION
1	Not used
2	RAM INTEGRITY test Continuously loops through all SDRAM Display ‘20’ if OK Display ‘22’ if ERROR
3	ADC/DAC test Continuously checks the main ADC operation
4	ACCESSORY OUTPUT test Checks all SYNC and relay outputs by toggling in a two second period. Display ‘40’ during this test
5	Not used at present
6	SLIT MOTOR test Initializes the stepper motor to the lateral slit position and then continuously cycles at full speed back and forth of this position with a 1second interval between direction changes. Display ‘66’ while the motor is resetting Display ‘60’ while it is being cycled
7	DEUTERIUM LAMP test Enables the filament and then switches on the lamp. Displays ‘66’ during filament on Display “60” when lamp is operating
8	VIS LAMP test Displays ‘86’ prior to enabling lamp Displays ‘80’ while it is running
9	Not used at present
10	EEPROM PARAMETER ERASE The entire contents of the EEPROM will be erased. Does not effect the program resident in the Flash memory. Displays ‘06’ while erasing Displays ‘00’ if erasure OK Displays ‘02’ if ERROR
11	FLASH MEMORY test Continuously tests CRC/checksum read/write in the main program in the flash memory. Displays ‘00’ if OK Displays ‘01’ if ERROR
12	CMOS ERASE The entire contents of the CMOS will be erased. Does not affect the program resident in the Flash memory.

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#	DESCRIPTION
13	Not used at present
14	Erase IP setting in EEPROM
15	Detector uses Extended Boot Block to initialize

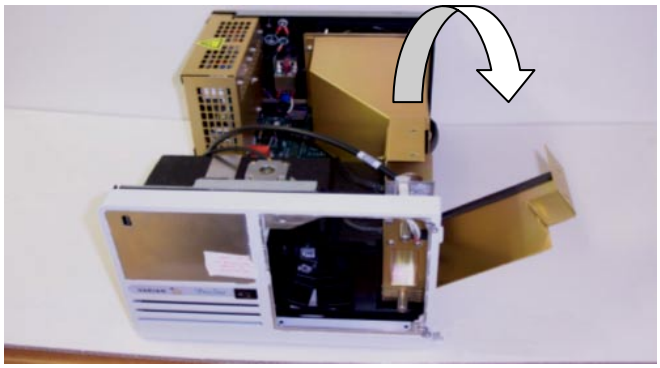
4.7 Removal & replacement procedures

4.7.1 Processor PWB

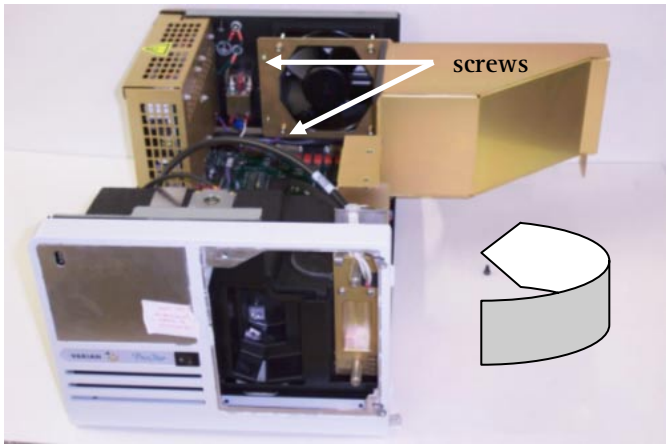
Note: Whenever this PWB is replaced, you must manually re-enter the wavelength calibration factors belonging to the optics module, into the EEPROM.
Refer to the Diagnostics section for details.

Removal

- Switch off detector and unplug mains cable.
- Remove the detector's top main cover which is held by two screws on each side.
- Remove the two screws securing the small side panel and lower it down as shown.

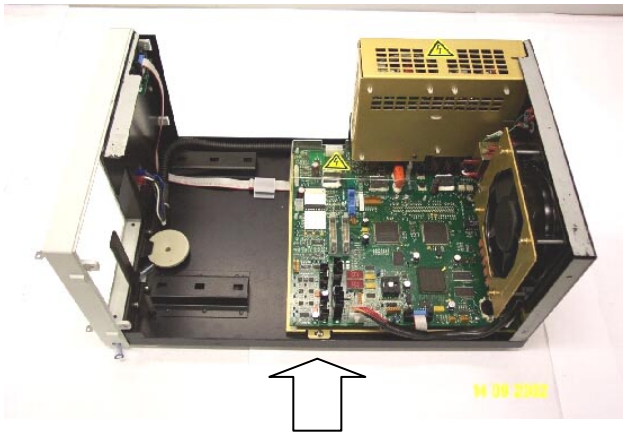


- Locate and remove the two screws at the rear of the detector used to secure the fan baffle. Then, swing the baffle to the right as shown.



- Locate and remove the two screws on the rear panel

- Remove the optics module as described in the Optics section of this manual.
- Remove the earth lug screw located on the Processor PWB.



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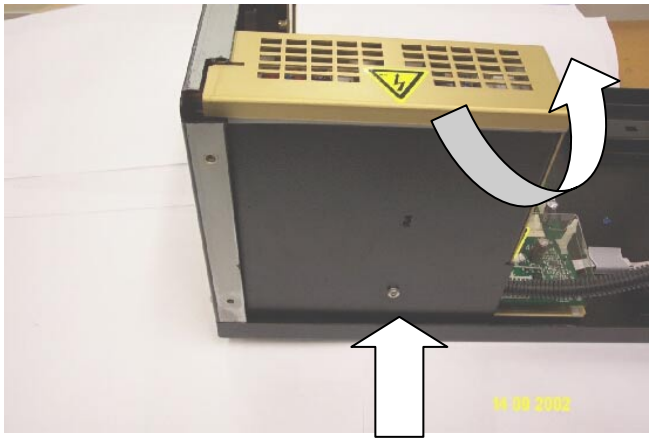
- Remove the single screw holding down the power supply module. This is located on the outer edge of the detector adjacent to the power supply module.



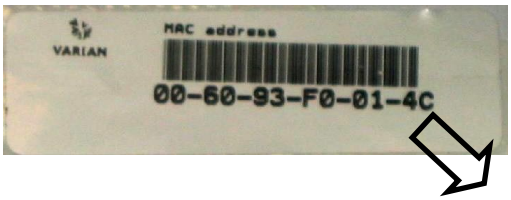
- Disengage the safety cover and slide the power supply module toward the front of the detector. At this stage the mains supply input cables are still connected. Place the power supply module in the service position as shown below, and fasten in this position using the screw which originally held it in place.
  The Processor PWB will now be exposed.
- Disconnect all cables from the Processor PWB.

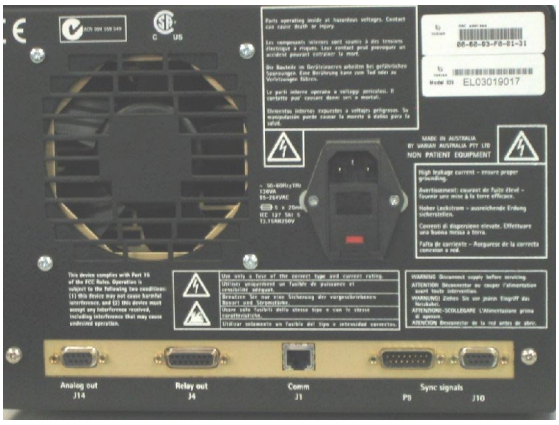
The PWB can now be removed along with its mounting bracket.

Replacement

When a new replacement Processor PWB is received, it will be accompanied by a new MAC address label.

This label needs to be stuck over the existing label located on the rear panel of the detector as shown below.
The detector serial number will remain the same.





The Processor PWB replacement procedure is the opposite of the removal procedure.
Note: Whenever this PWB is replaced, you must manually re-enter the wavelength calibration factors belonging to the optics module, into the EEPROM.
Refer to the Diagnostics section for details.

4.7.2 Power Supplies

- Remove the main detector cover.
- Remove the single screw holding down the power supply module. This is found on the outer edge of the detector adjacent to the power supply module.
- Disengage the safety cover and slide the power supply module toward the front of the detector (as described above in the Processor PWB removal procedure).
- Remove the plastic protective cover and cut all cable ties around the internal cables in the supply module as shown.

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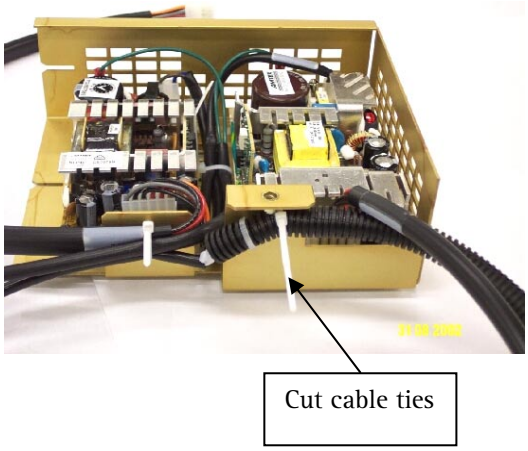
- Disconnect the two main cables from the supply.



4.7.3 Fan replacement

- Remove the fan baffles as described above in the Processor PWB replacement procedure.
- Place the power supply module in the service position as described above.
- Disconnect plug P3 from the Processor PWB.
- Remove the four screws from the rear panel of the detector which secure the fan.

Note: For cooling purposes, it is important when replacing the fan that the orientation is correct. The air flow must enter the detector through the rear and flow through the fan baffles. There is an arrow marked on the fan which must point towards the front of the detector.

4.7.4 Fuses

The ProStar335 contains two fuses which are located at the back of the detector. To replace a fuse, disconnect the detector from the power supply, and replace the blown fuse with one of the type and rating as indicated in the Specifications section of this manual or on the silk screening adjacent to the fuses.

The fuses have a code marked on the cap (e.g. T3.15AH250V). This refers to the fuse characteristic ('T' - time lag, 'F' - fast acting), the current rating ('x' amperes), the breaking capacity ('H' - heavy, 'L' - low) and the voltage rating ('y' volts). This code must correspond to the code appearing next to the fuse holders.

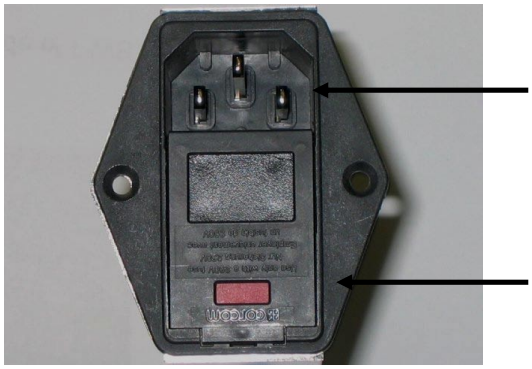
Note: Always check the information printed on the rear of the detector for the most up-to-date details regarding the fuse type.

To check a fuse -

1. Disconnect the detector from the mains power supply.
2. On the mains input connector (rear panel), lift the fuse cap and pull out the fuse holder (lower red section).
3. Both fuses are held in this red fuse holder.
4. Check that the fuses are the correct type and are not damaged. If necessary, replace them.
5. Place the fuses into the red fuse holder, push the holder back into the mains input connector and then lower the cap.
6. Reconnect the detector to the mains power supply.

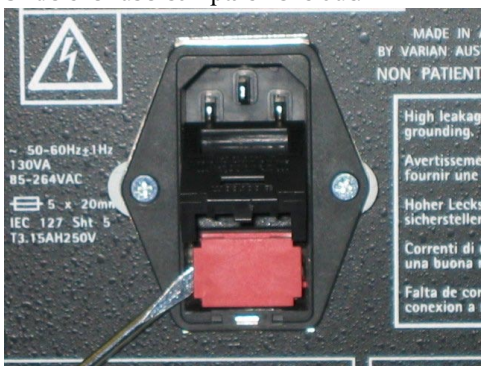
WARNING:
FIRE HAZARD

To avoid fire hazard replace fuses ONLY with fuses of the same rating and type. Always switch off the AC power and unplug the power cord before replacing a fuse.



To expose the fuse compartment, lift the cap using a small flat blade screwdriver.

Slide the fuse compartment out.



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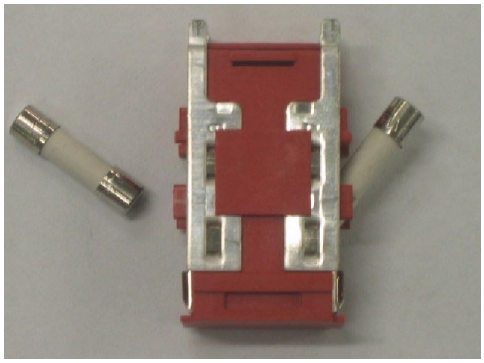
The two fuses are located on either side of the compartment.



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5 Optics

5.1 Introduction

The ProStar 335 is a high performance photodiode array detector that can simultaneously detect absorbances across a wavelength spectrum from 190nm to 950nm. The photometric performance of any LC detector is largely determined by the quality of the polychromator. With UV-Vis detectors, the polychromator design is aimed at providing a desired wavelength resolution while maintaining high light throughput and low stray light.

The optics must;

- Efficiently couple light from the lamps to the polychromator
- Split the light into sample and reference beams without excessive light loss
- Focus these beams into the flowcell compartment
- Collect the light from the polychromator and direct it to the photodiode detectors.

The ProStar 335 optics is designed around a polychromator using quartz over-coated optical components. The detector is capable of operating in the wavelength range from 190-950nm. Dual silicon photodiode array detectors provide an output for measurement by the electronics system.
It is not possible to perform any optical alignment or replace any optical components within the ProStar 335. The optics module is designed to be replaced as a complete assembly.

5.2 Optics module

The optics module contains the UV and visible source lamps, source optics, beam splitter, slit wheel, polychromator and mirror assemblies that form the sample and reference beams.
This module is located towards the front of the detector and can be easily removed and replaced if necessary as described later in this section.

5.2.1 UV lamp assembly

The UV light source is a high output deuterium lamp capable of emitting light from 190nm to 950nm. The intensity in the UV region, <450nm, is much higher than in the visible region. The lamp assembly consists of a deuterium lamp which is rigidly cemented onto a mounting bracket and comes pre-aligned. User replacement is easy as no alignment procedure is necessary. Each lamp has a life expectancy of 2000 lamp hours.
The mounting bracket holds two thumbscrews that are used to help locate the assembly in its correct position. This ensures that the lamp is properly aligned when it is mounted to the optics module.

Removal and replacement procedures are described in this section of the manual.
Whenever the deuterium lamp is replaced, a lamp calibration must be performed as described in the Electronics section.

5.2.2 Visible lamp assembly

The visible source lamp is used to provide the necessary light intensity required in the visible range (>350nm). It provides high light throughput at the longer wavelengths where the deuterium lamp is less intense. To match the UV intensity provided by the deuterium lamp, the type of visible lamp used is a 10W tungsten halogen lamp. It mounts on top of the optics module and is held in place by two screw terminal connections. These are in a fixed position therefore allowing replacement of the lamp without the need for alignment. The visible lamp has a life expectancy of 2000 lamp hours.
Whenever the visible lamp is replaced, a lamp calibration must be performed as described in the Electronics section.
Removal and replacement procedures for this lamp are described in this section.
A 20% attenuator is used to reduce the visible lamp intensity near the 700nm peak so it is better matched to the deuterium intensity near 250nm.

5.2.3 Polychromator

Grating details

Grating size:	25mm x 25mm x 6mm
Blaze angle:	2.1°(UV)
Blaze wavelength:	250nm (UV-Vis)
Lines per mm:	300 lines/mm (UV-Vis)
Reciprocal dispersion:	30nm/mm (UV-Vis)

5.2.4 Optical path

Light coming from either source lamp is matched in size and has a diameter of 0.5mm. Two lenses are used to image the light so it overfills the 1mm entrance mask. Overfilling of the mask is done to minimize noise and any wavelength drift caused by mechanical movements under temperature changes. The beam passes through a focusing lens before hitting the beam splitter. The sample path consists of mirror N1 and the reference path consists of mirrors N2 & N3.
The two beams then pass through a 1mm entrance mask, which shapes the beam to the geometry required before the beam enters the flowcell. Upon leaving the flowcell the beams pass through a slit before entering the polychromator. This slit helps determine the resolution of the detector optics.
In the polychromator, the light is directed onto the entry collimating mirror and then onto the grating. The dispersed light then hits the exit collimating mirror. From here the beams are focussed onto the dual photo-diode detectors.

Entrance slits
The slit pairs are located on a slit wheel that is software selectable and stepper motor driven. Slit widths of 1nm, 2nm, 4nm, 8nm and 16nm are available and determine the optical resolution of the detector. Resolution can be as high as 1nm for measurement of compounds with a fine structure, or alternatively they can be opened to 8 or 16nm for maximum light throughput.
Using a wider slit allows more light to reach the photodiodes and increases sensitivity. However, wavelength sensitivity will suffer.
A narrower slit will offer greater wavelength selectivity, but sensitivity will suffer due to less light reaching the photodiodes.

Beam splitter
The beam splitter is a silica plate with aluminium dots that divides the beam into 50% sample light and 50% reference light. This enables an extended dynamic range to be achieved.
It is a silica window coated with circular dots that cover approximately half its area.

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Polychromator

The polychromator uses dual 1024 diode array for both sample and reference channel. The detector has a spectral range of 190nm to 950nm at 0.75nm per diode. For analytical (single flow path detectors), the reference array is replaced by two single diodes located at 250nm and 600nm.
Interference filters placed on the array windows suppress second order stray light.

Flowcell assembly

The function of the flowcell is to direct light from the lamp sources, through a sample/solvent flow path, and then into the polychromator. Focusing is achieved by quartz optics lenses fitted to both ends of each light path inside the flowcell. The body of the flowcell is made from titanium and has a working pressure range of approximately 7MPa.

1psi = 6.89476 kPa

1000psi = 6.89476MPa, or ≈ 7MPa

The flowcell is designed for easy removal, installation and replacement. Instructions for the removal and replacement are given in the Installation section of this manual.

The diagram below illustrates the precision of the flowcell internals and the shape of the two beams passing through both paths.
High source lamp throughput is achieved by forming light images of a maximum size at each end of the flowcell. This creates a precise beam of light that just clears the internal flowcell walls. This factor must be considered when the flowcell is installed and highlights the importance of a correctly seated fowcell.
To ensure the beam is clear of the cell walls, limiting apertures are placed before and after the cell and cell optics. One is the entrance slit before the polychromator, and the other is a mask which precedes the flowcell.

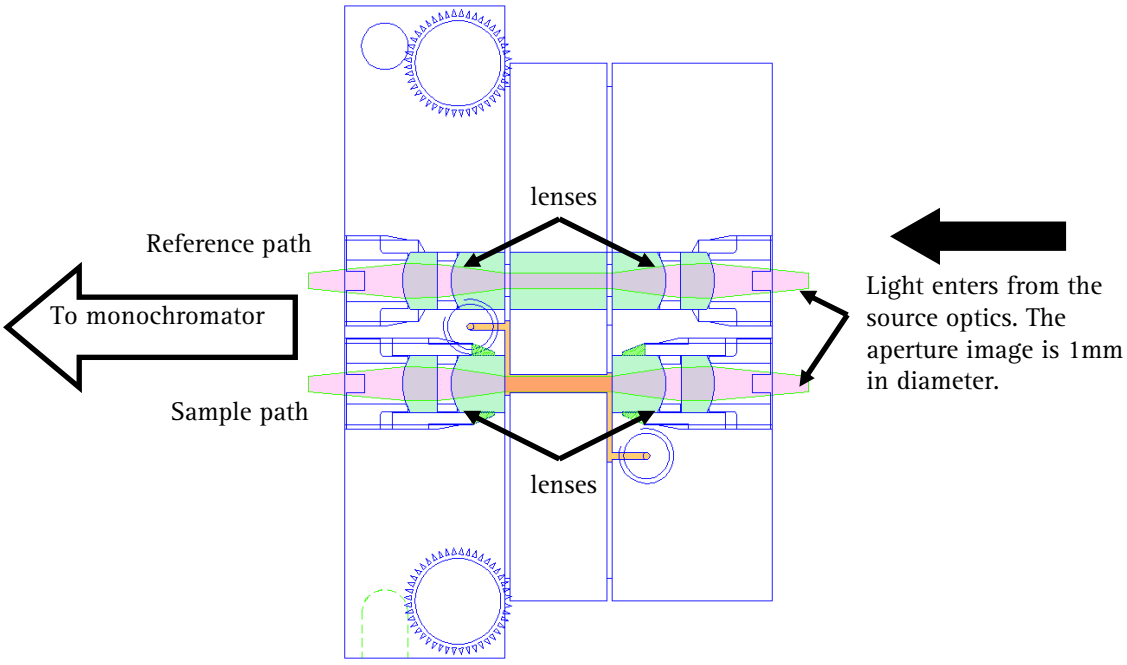
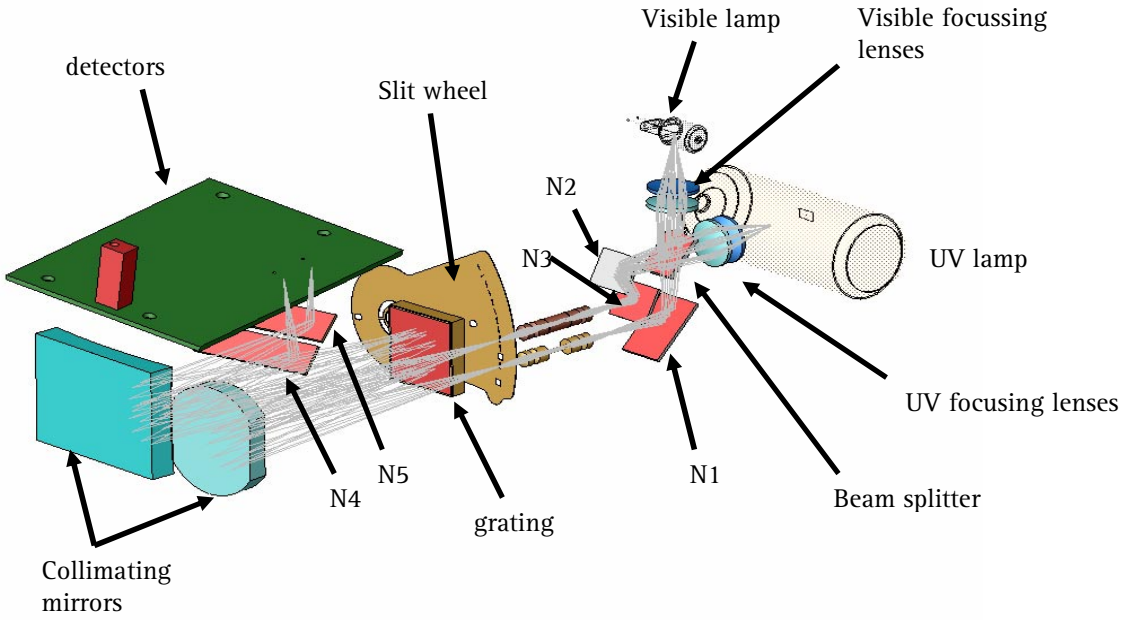
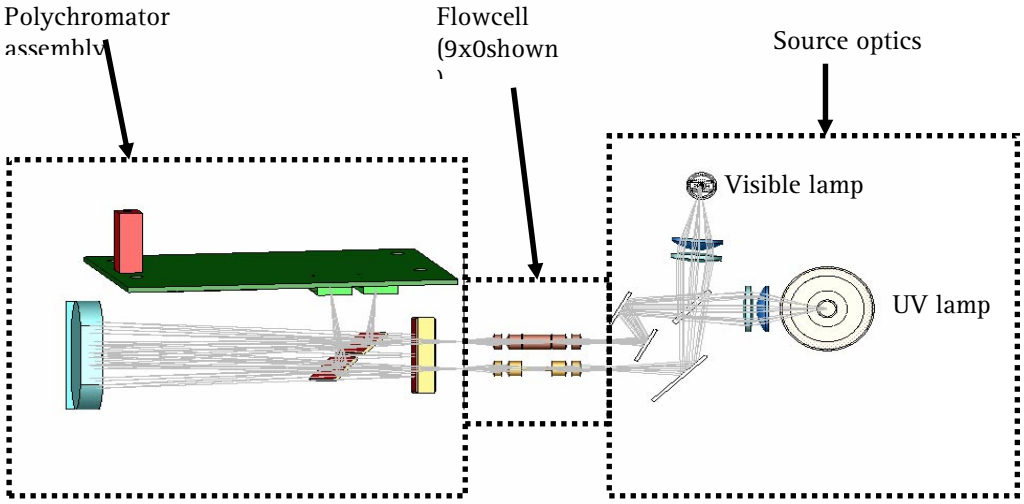


Illustration shown is of a 9x0



Optical ray trace diagram



ProStar 335 optical system

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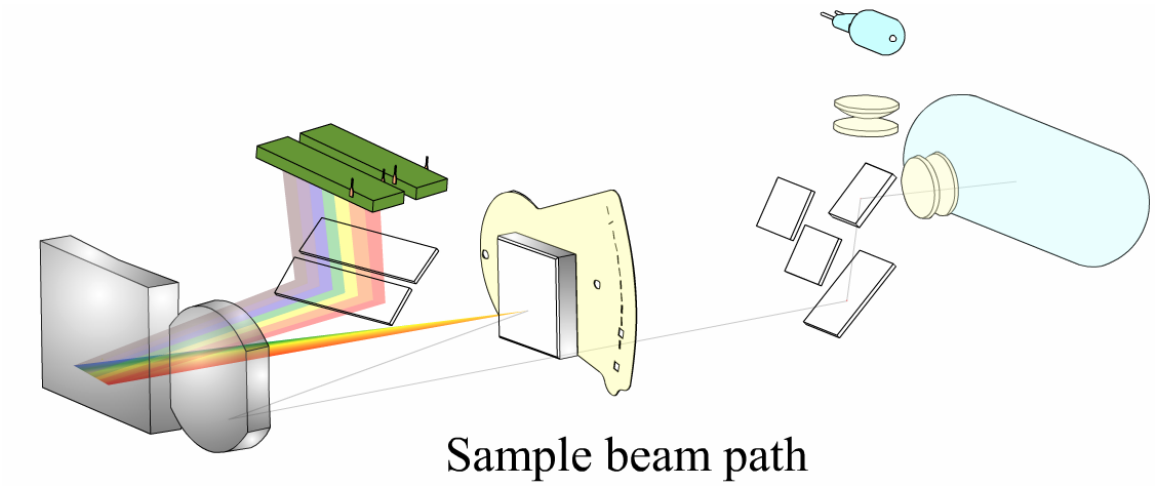
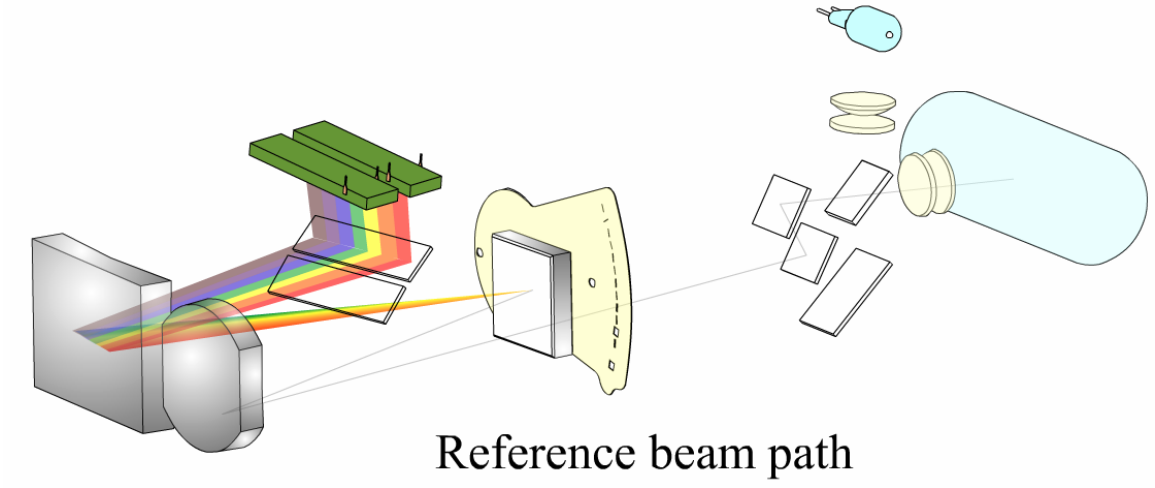
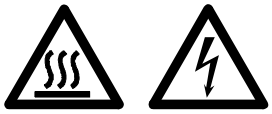


Sample beam path



Reference beam path

5.3 Removal and replacement procedures



Warning
Lamp surfaces and mounting brackets will become hot during operation and will remain hot for some time after being switched off. The temperatures are sufficient to cause burns.
The UV lamps operate at high voltage. Contact with this voltage can cause death, serious injury, or painful electric shock.
Before changing either the UV or visible lamps, **always** switch the detector off, remove the power supply cable and allow the lamps to cool.

Caution
Care must also be taken when removing lamps. Touching the glass envelope of either the UV or visible lamp will reduce its efficiency. Never touch the glass surfaces of new lamps.
Aways handle a lamp by its base, or use a tissue or cloth.

Warning
Hazardous UV radiation is emitted by the UV lamp. This radiation can cause serious damage to human eyes. Never operate a UV lamp outside of its correct position in the lamp turret

5.3.1 UV lamp source

Note: **You must perform a lamp calibration after replacing the deuterium lamp. See Electronics section for details.**

Removal procedure

- Remove the front green door which will then expose a flat panel.
- Remove this flat panel by loosening the holding screw on the top left hand corner. This will expose the UV lamp housing which is located on the right hand side of the opening.
- Disconnect the lamp from the 3-way connector.

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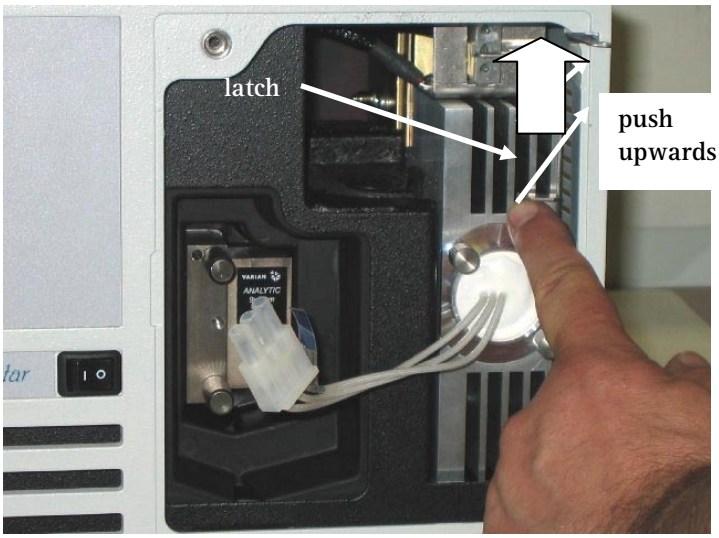
- Locate the safety interlock latch and push it upwards as far as it goes.



- Loosen the two thumbscrews located at the front.

- Holding the lamp module by these thumbscrews, carefully pull out the assembly.

Replacement

The replacement procedure is the opposite of the removal procedure.

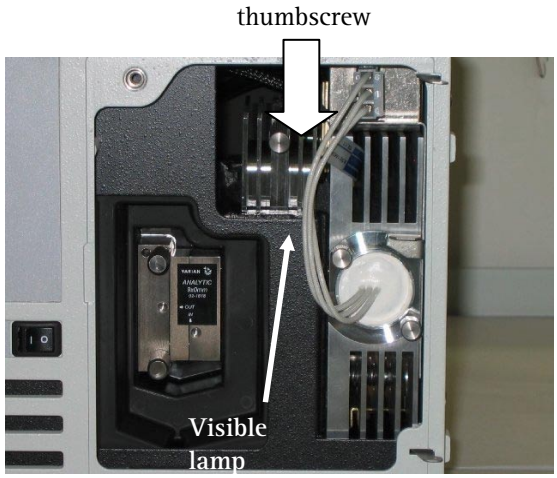
- Carefully place the lamp assembly into position
- Tighten the two thumbscrews
- Engage the safety latch by sliding it back down.
- Re-connect the three way connector

5.3.2 Visible lamp source

Note: **You must perform a lamp calibration after replacing the visible lamp. See Electronics section for details.**

Removal Procedure

- Remove the front green door which will expose a flat panel.
- Remove this flat panel by loosening the holding screw on the top left hand corner.
- Locate the visible lamp housing.
- Loosen the thumbscrew and carefully remove the housing.



- Note that the visible lamp does not come away with the housing.
- Using a cloth to handle the lamp, gently pull it forward until it comes away from its terminations.

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Replacement

- Holding the replacement lamp with a cloth, slide the two pins on the visible lamp into the connector terminals as far in as possible.
- Replace the lamp housing and tighten the thumbscrew.

Caution

When handling the new lamp assembly, DO NOT TOUCH the lamp glass as oil from your fingers will permanently etch onto the lamp surface.

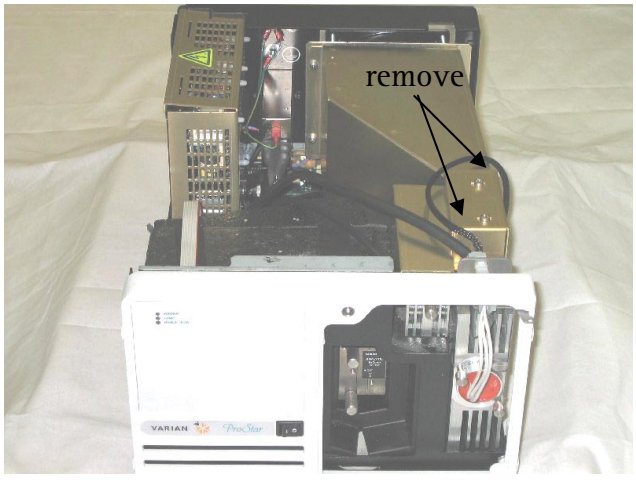
5.3.3 Optics module

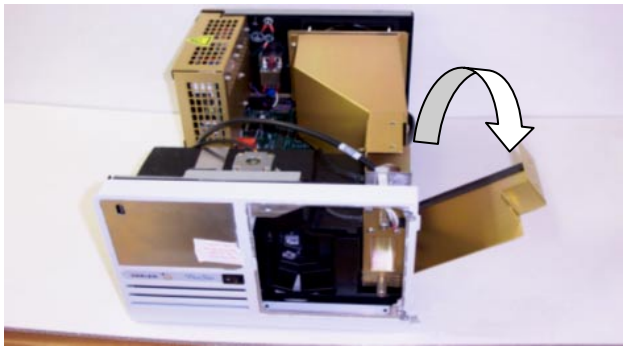
It is not possible to perform any optical alignment or to replace any optical components within the ProStar 335. The optics module consists of the polychromator and all other optical components. It is designed for modular replacement.

Note: Whenever the optics module is replaced, you are required to enter the wavelength calibration coefficients that accompany the new module into the EEPROM as detailed in the Diagnostics sections. You are also required to perform a lamp/0%T calibration as described in the Electronics section.

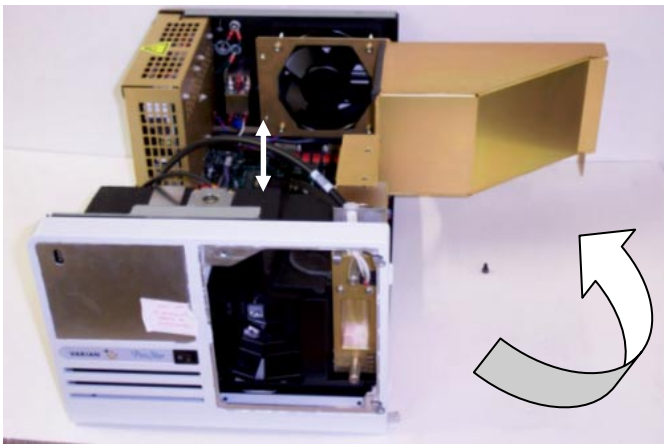
Removal

- Remove the detector's top main cover. It is held by four screws on each side.
- Slide the detector forward on a bench to enable access to three locating holes underneath. These are found towards the front of the detector. Using a 7mm nut driver, remove the three nuts and washers found in these locating holes. These are holding the optics module to the main detector chassis. Once removed, slide the detector back fully onto the bench.
- With the detector sitting flat on a bench, remove the two screws securing the small side panel and lower it down.

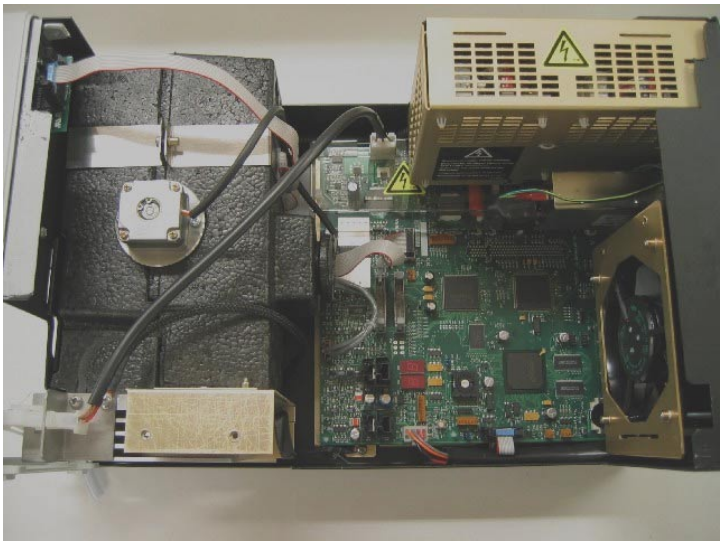




- Locate and remove the two screws used to secure the fan baffle. These are at the rear of the detector near the fan. Swing the baffle to the right. (These steps are also required for removing the Processor PWB).



- On the Processor PWB, disconnect P13, P17, P22 & P15.



- Carefully lift the optics module out of the detector and place safely on a flat bench.
- Remove the two cable ties that secures the black foam padding around the optics module.

- Take off all the padding pieces to expose the polychromator.

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Publication date: April 2004

6 Spare parts

Location of major assemblies

This section contains ordering information for spare parts that are currently available for both the Prostar 325 & 335 model detectors.
All parts are common to both detectors except for;

- main electronics PWB
- optics modules

6.1 Covers

Part Number	Description
01 107220 00	ASSY PANEL DOOR
09 101922 00	COVER LC DETECTOR BASE
01 107218 90	ASSY CASTING LC DETECTOR FRONT
01 107288 00	ASSY DOOR
09 102066 00	CAP DOOR ASSY
01 107146 90	ASSY FLOWCELL SURROUND

6.2 Electronic spare parts

PWB's

Part Number	Description
02 101797 90	ASSY PWB FRONT PANEL LED/IrDA
02 101953 90	ASSY PWB DETECTOR PROCESSOR (ProStar 335)
02 101759 90	ASSY PWB DETECTOR PROCESSOR (ProStar 325)
02 101865 90	ASSY PWB REAR PANEL INTERFACE
02 101875 90	ASSY PWB RELAY INTERFACE

LOOMS

Part Number	Description
01 107159 00	ASSY LOOM IrDA DISPLAY
01 107155 00	ASSY LOOM VIS LAMP
01 107156 00	ASSY LOOM D2 LAMP INTERCONNECT
01 107152 00	ASSY LOOM PRE-AMP CONTROL
01 107157 00	ASSY LOOM POWER SUPPLY
01 107158 00	ASSY LOOM MAINS
01 107650 00	ASSY RIBBON PRE-AMP CONTROL (common)
01 107651 00	ASSY LOOM PRE-AMP CONTROL (dual array)

ASSEMBLIES

Part Number	Description
79 100447 00	ASSY POWER SUPPLY +5V, +/-12V
79 100448 00	ASSY POWER SUPPLY +24V
01 107192 90	ASSY FAN
48 100359 00	SWITCH MAINS
12 101313 90	ASSY CORCOM MAINS FILTER

6.3 Optical spares parts

ASSEMBLIES

Part Number	Description
01 107645 90	ASSY OPTICS COMPLETE (single array) ProStar 335
01 107646 90	ASSY OPTICS COMPLETE (dual array) ProStar 335
01 107202 90	ASSY OPTICS COMPLETE (ProStar 325)

LAMPS

Part Number	Description
01 107154 00	ASSY D2 LAMP MODULE PRE-ALIGNED
56 101365 00	LAMP MINIATURE QUARTZ HALOGEN

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FLOWCELLS

Part Number	Description
02 101818 00	FLOWCELL 9x0 ANALYTICAL
02 101819 00	FLOWCELL 9x1 PREP
02 101820 00	FLOWCELL 4x0.15 SUPER PREP
02 101821 00	FLOWCELL 4x0 SEMI MICRO

6.4 System cables

Part Number	Description
01 107234 00	ETHERNET CROSSOVER (LC to PC)
01 107233 00	ETHERNET CABLE (network configuration)
01 107438 00	RELAY INTERFACE CABLE (for PWB Relay I/F)
01 107441 00	SYNC INTERFACE CABLE (for PWB Rear Panel I/F)
01 107442 00	ANALOG SIGNAL CABLE

6.5 Miscellaneous

Part Number	Description
01 107433 00	ASSY BACK PRESSURE REGULATOR
16 101265 00	FITTING 1/16 TUBE NUT/FERRULE FLAT BOTTOM (Pack of 10)
16 101269 00	FITTING 1/8 TUBE NUT FLAT BOTTOM (each)
16 101264 00	FITTING 1/8 TUBE FERRULE (Pack of 10)
85 102114 00	PROSTAR 335 SOFTWARE CD
85 102113 00	PROSTAR 335 OPERATORS MANUAL
85 10xxxx 00	PROSTAR 335 DIAGNOSTICS CD
85 102015 00	PROSTAR 325 SOFTWARE CD
85 102016 00	PROSTAR 325 OPERATORS MANUAL
85 102078 00	PROSTAR 325 DIAGNOSTICS CD

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Publication date: April 2004

7 Diagnostics

7.1 Introduction

To run the service diagnostics program for the ProStar 335 detector, you will need to insert the Verify CD into a computer CD ROM drive and connect the PC to the detector via the Ethernet connection.
From the Windows task bar select Start>Run>Browse. On the CD find the file Service/Diagnostics/PolyDiagnostics.exe. This will execute the LC PolyDiagnostics application which you can use to verify all working aspects of the detector. To run the program from the local pc, you must save all the files associated with the diagnostics program to the same directory.

7.2 Functions of PolyDiagnostics

PolyDiagnostics.exe is a standalone application that is run directly off the CD. The program can be used to;

- verify lamp operation
- verify Ethernet communications
- configure TCP/IP addresses
- verify all relay operations
- check operation of signal processing
- monitor voltage supplies
- check all external connections
- build methods and download into the detector
- upload the internal method from the detector

You can also enter important information into the EEPROM such as;

- detector installation date
- lamp installation date
- lamp serial number
- detector serial number
- customer details

Menu task bars

The top menu bar allows for;

file management tasks

editing options

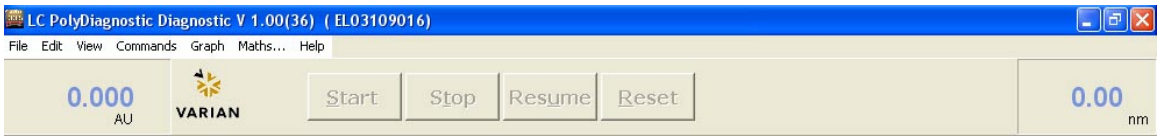
graph & trace options

mathematics calculations

execution of system commands

Help files

Below the top menu bar are the four control buttons: Start, Stop, Resume and Reset. These buttons are used to control the tests that PolyDiagnostic performs on the detector.



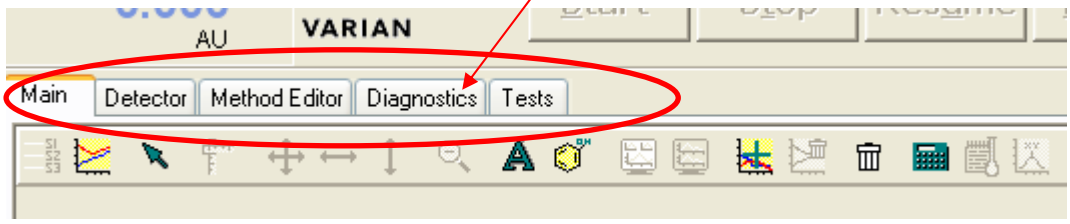
On either side of the control buttons are real-time digital readouts of intensity and wavelength. You will see these values change as the detector is running a test.

The second menu bar is common to all pages.

There are five pages used for various functions:

- Main – for viewing traces
- Detector – for establishing communications and status of the 335
- Method – for building custom methods
- Diagnostics – for running tests to confirm operation
- Tests – for running tests not covered in the Diagnostics tab

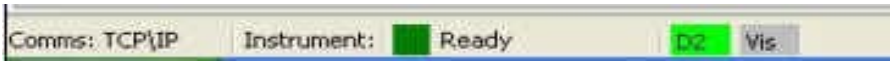
Each one can be selected by clicking on its respective tab.



Status bar

The status bar will always appear at the bottom of the screen. It indicates the status of;

- detector
- lamps
- Ethernet connection



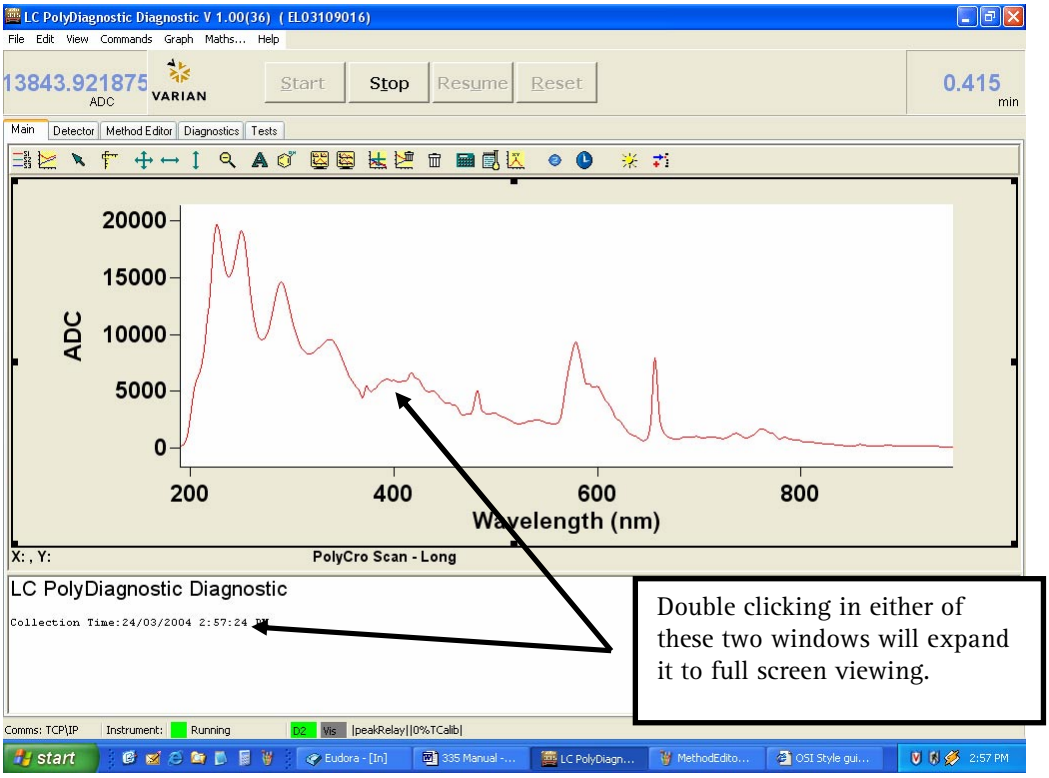
Various colors indicate different status levels. These are detailed in the “Detector Status” description section of this manual.

Publication date: April 2004

Main Tab

The Main page is used to view spectrum traces collected during troubleshooting and detector performance verification.
The trace window can be expanded to any size by dragging out its edges. Double clicking in the trace window will also toggle the size of the window, making it possible to view report information such as method parameters as well as the spectrum trace on the one page.

When moving the cursor across the spectrum, the X&Y co-ordinates will be shown in the bottom left corner of the trace window.



Located immediately above the trace window is the graph menu bar. It allows for;

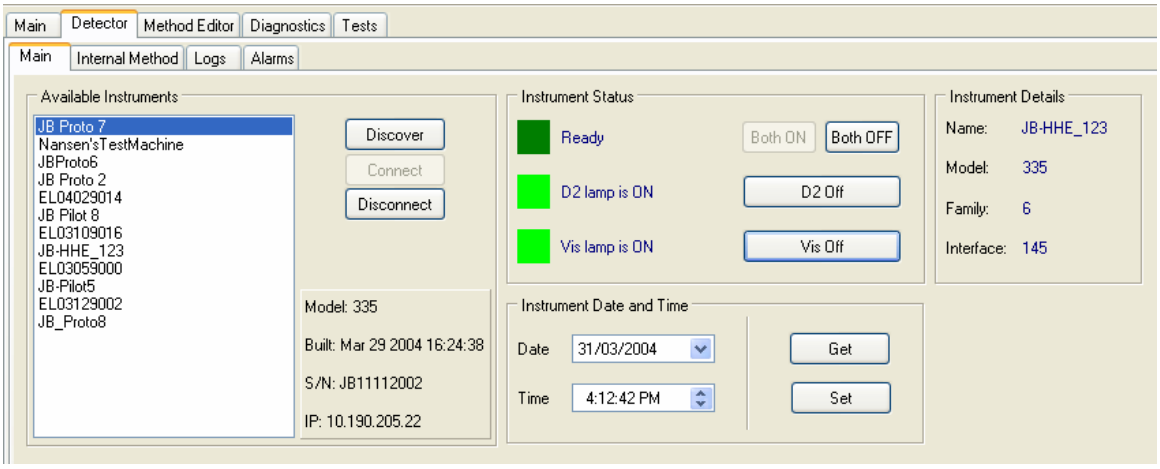
- trace zooming and selection
- cursor options
- auto scaling axis
- annotation and picture adding
- multiple graph layout options
- add and remove individual graphs
- mathematics functions
- peak labelling

Detector Tab

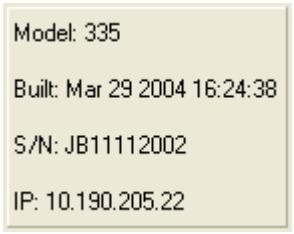
Entering this page will display a further four sub-pages located within.

Main

The Main sub-tab is used to control the connection to the detector and view specific details including the status of each lamp. To turn the lamps on, click one of the “lamp on” buttons in the Detector Status section of the window.



Available Detectors – Use the Discover, Connect and Disconnect buttons to manage the Ethernet connection to the detector. The text box displays all of the 335 detectors connected to the network. To view information about one of the detectors, select the detector with a single mouse click. Information about the detector will appear next to the text box.



You can connect or disconnect to any 335 detector on the network, as long as the detector is not currently being used by another program.

Detector Status – this will display the current status of the connected detector and indicate the state of the source lamps. These are individually color coded and each color is defined below.

Detector Status	Color
Not ready	Red
Ready	Green
Running	Lime green
Offline	Black

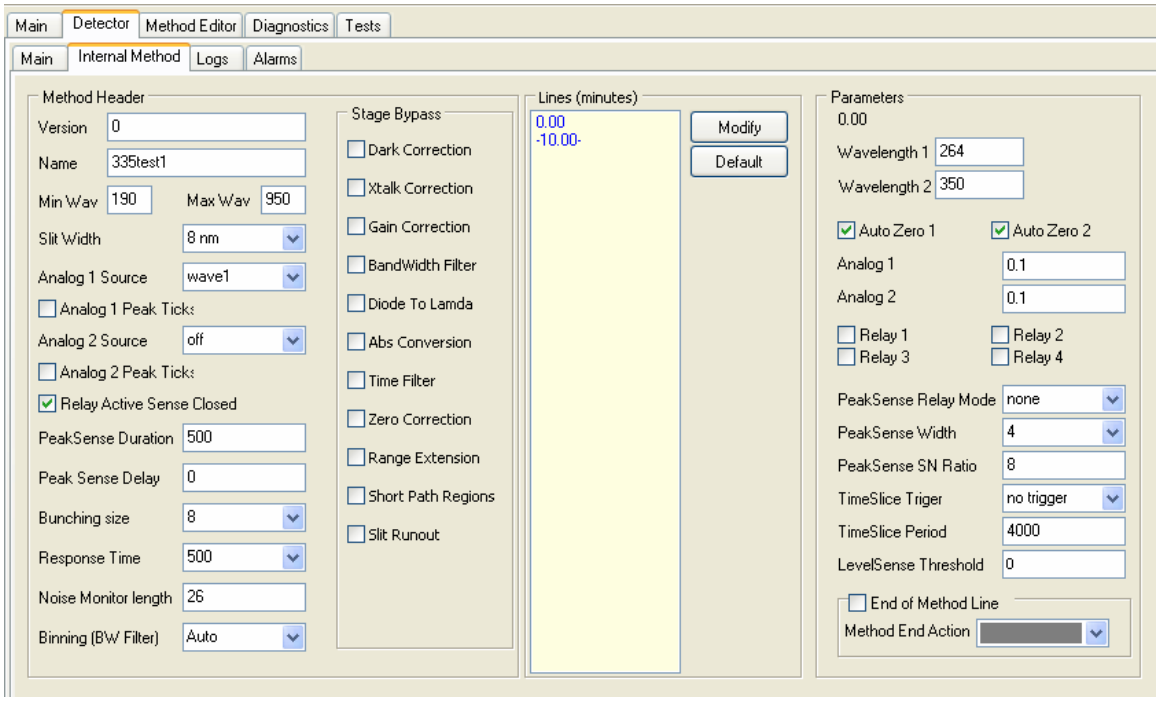
Lamp Status	Color
D2 lamp off	Grey
D2 lamp is warming	Yellow
D2 lamp is on	Green
Vis lamp off	Grey
Vis lamp on	Green

Detector Details – details such as name and model of the connected detector will be displayed here.

Detector Date and Time – displays the time and date as held by the detector's internal clock.

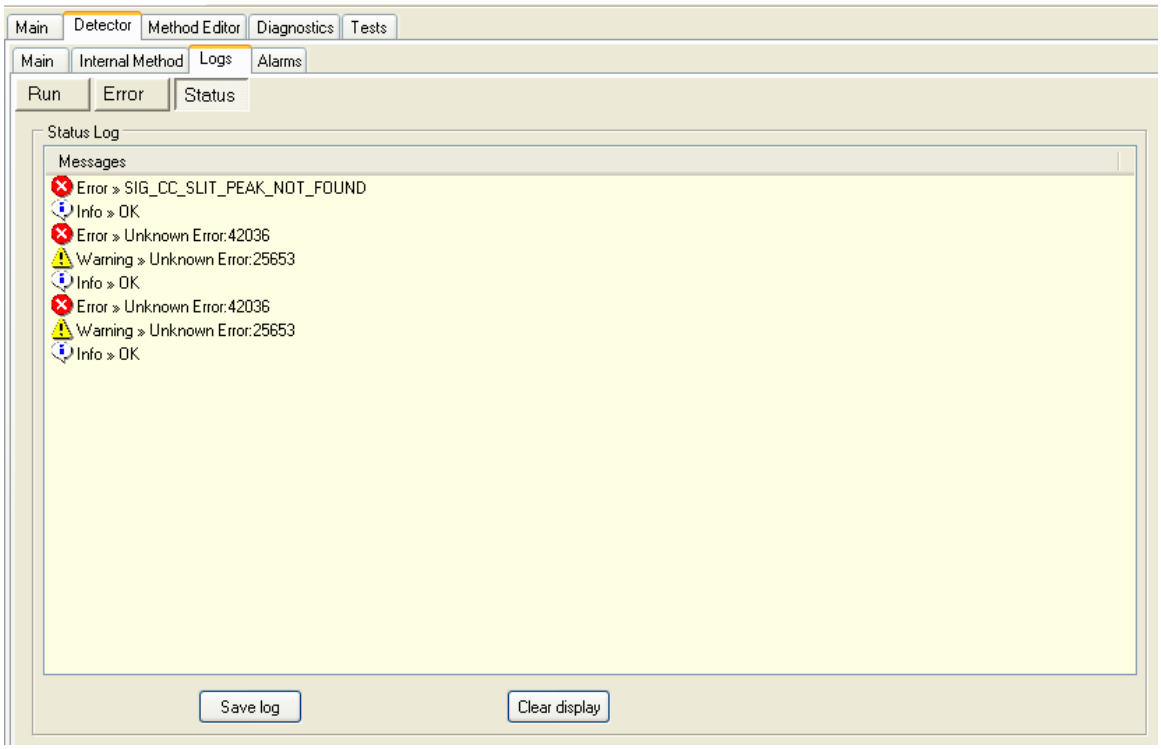
Internal Method

This page displays the details of the current method that is stored in the detector. If the detector is not performing as expected, the Internal Method page is used to check whether the detector is running the correct method.



Logs

These logs display the performed functions & reported errors. To view all of the recorded errors, click Error then the Get Log button that will appear at the bottom of the window. To see the current list of errors and messages, click the Status button.



Run Log

This will display an account of all functions performed by the detector.

Error Log

This will display an ongoing account of all errors encountered by the detector. The information will be displayed in the following format;

Date/Time/Function/Code number

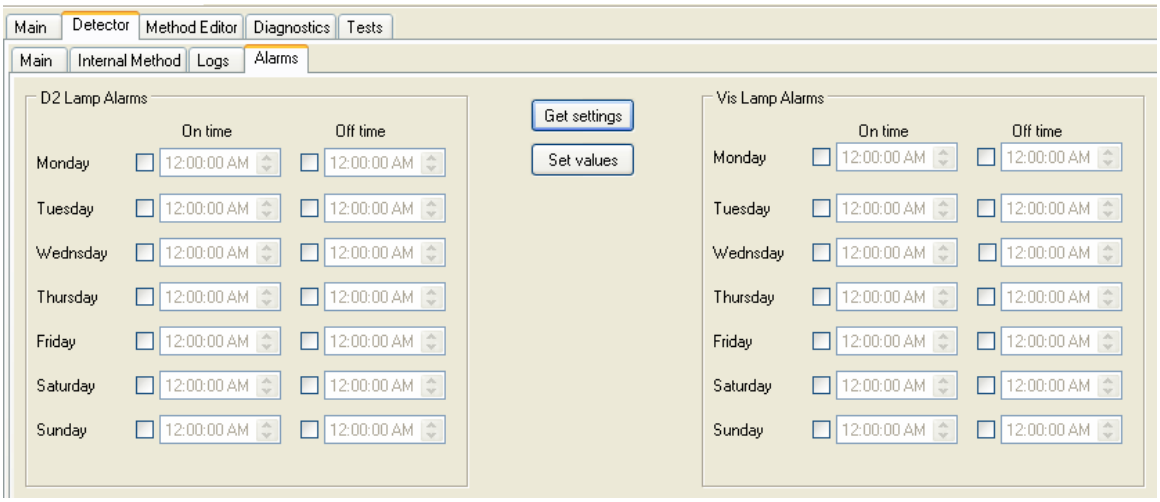
The error log can be saved in a text format by clicking on “save error log”.

Status

This will display the message history for the current session.

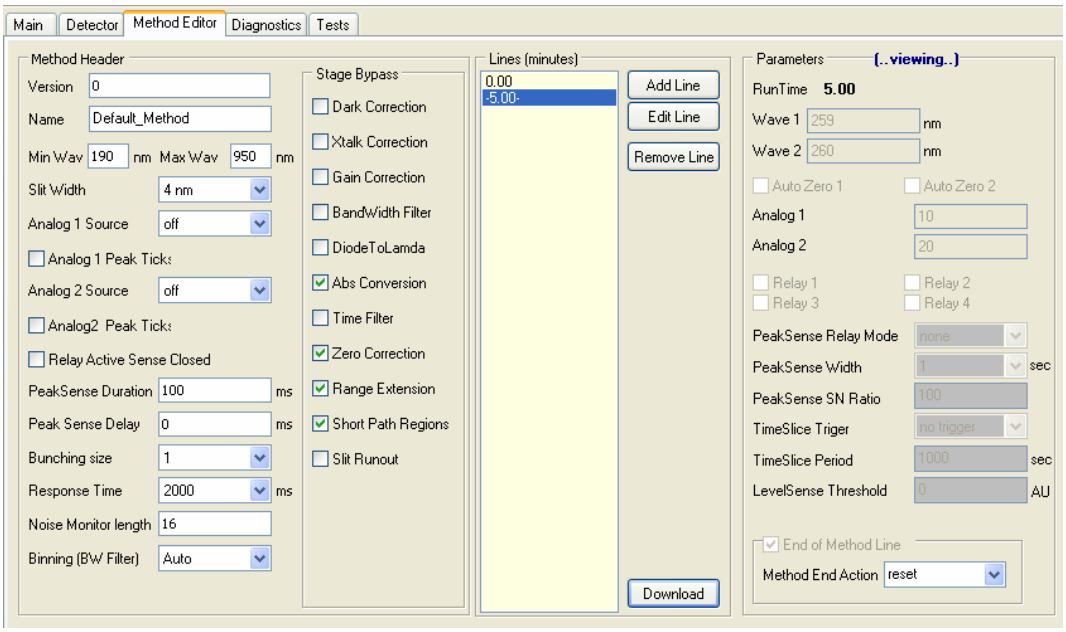
Alarms

The alarms page allows you to program either source lamp to switch on and off at specified times. This is useful in turning the lamps on prior to using the detector and allowing them adequate time to warm up and stabilize. It uses the internal clock of the detector as its reference.



Method Editor Tab

This page is used for building methods. There are two modes of operation possible on this page, Editing & Viewing. The active mode is shown at the top of the parameters box. If you click on a line (-5.00- for example, as shown below) the actions that will be taken at that time in the method, will be shown in the Parameters box.



Method Header

The method header section contains the main parts of the method that are sent to the detector including the wavelength scran range, slit width, peak tick settings and noise smoothing functions. A method title can also be stored with a version number, but this is used mostly for development purposes only.

Stage Bypass

The Stage Bypass section forms part of the Method Header because it allows parts of the 335 signal processing to be turned off, which will affect the results you get from the detector. Be aware that some settings in the Stage Bypass can override values stored in the Method Header (eg. Checking the BandWidth Filter box will disable slit related smoothing, so the Binning (BW Filter) setting in the Method Header will have no effect).

Dark Correction* – Turns off each diodes dark current correction (expressed in ADC counts).

Xtalk Correction* – Turns off the cross talk correction from the short path to the long path.

Gain Correction* – Obsolete. This function is no longer used.

BandWidth Filter* – Turns off the wavelength noise correction.

DiodeToLamda – Changes the corrected wavelength values back to absolute values related to the diode position. This function is useful for checking whether the light beam has moved off the end of the array.

Abs Conversion – Turns off the absorbance conversion so the data from the 335 is received in ADC counts. It is useful for checking the gain table, when Zero Correction and Range Extension are also bypassed.

Time Filter* – Turns off the time noise correction.

Zero Correction – Turns off the baseline auto-zero.

Range Extension – Turns off the absorbance dependent blending (and switching) between the long and short paths. The graph will display both paths separately. This function allows you to see peak saturation but is really only useful for the dual array.

Short Path Regions – Turns off the filtering and blending of the reference diodes in the single array.

Slit Runout – Turns off the wavelength correction that adjusts for differences in the slit width position.

*Used only for development purposes.

Lines (minutes)

This section allows timed events to be programmed into the method. There is a single line beginning at time 0.00 minutes that cannot be removed. You can add any number of lines to a maximum of 50 and execute those lines at any time up to 14400 minutes.

To add a line to a method, select the Add Line button. You will now activate the editing mode function and the top of the Parameters window will indicate this accordingly. To exit the line edit function, press the OK or Cancel buttons in the Parameters window.

To mark the end of method, a line must be assigned an End of Method instruction. This is done while in editing mode and is evoked by selecting the End of Method Line check box. Then, choose a desired action from the two options given; Hold or Reset.
It is possible to assign multiple command lines an End of Method instruction. They will appear in the format “–25.00-“.

Parameters

The Parameters section of this window shows all the method parameters stored in each line of the method. To edit a line, highlight it and click the Edit Line button in the Lines (minutes) window. Change the required parameters and click OK

Method Download

When a method has been completed it must be downloaded to the detector before you can press the Start button at the top of the program window.

Click

then

to run the method.

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Diagnostics Tab

Entering this page will display a further eight sub-pages located within.

Main

Input/Output

EEPROM

Development

Comms

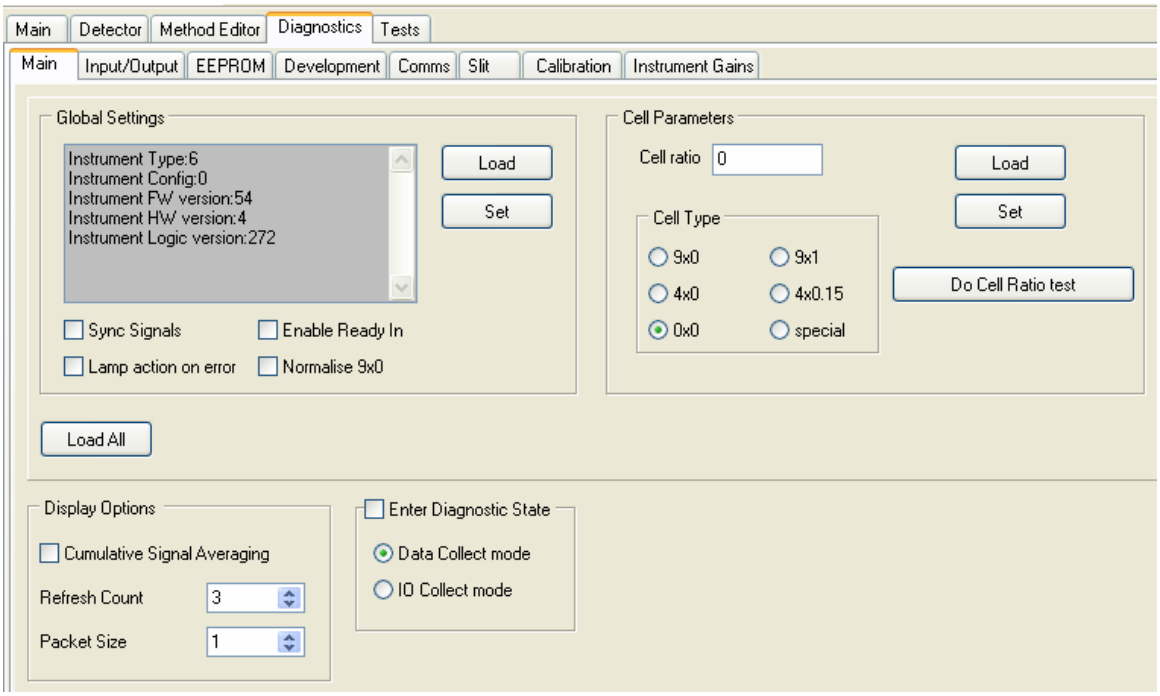
Slit

Calibration

Detector Gains

Main

The main sub-tab allows you to see the Hardware and Firmware versions of the detector, set the flow cell type, change the Display Options and tell the detector to enter a special mode called Diagnostic state.

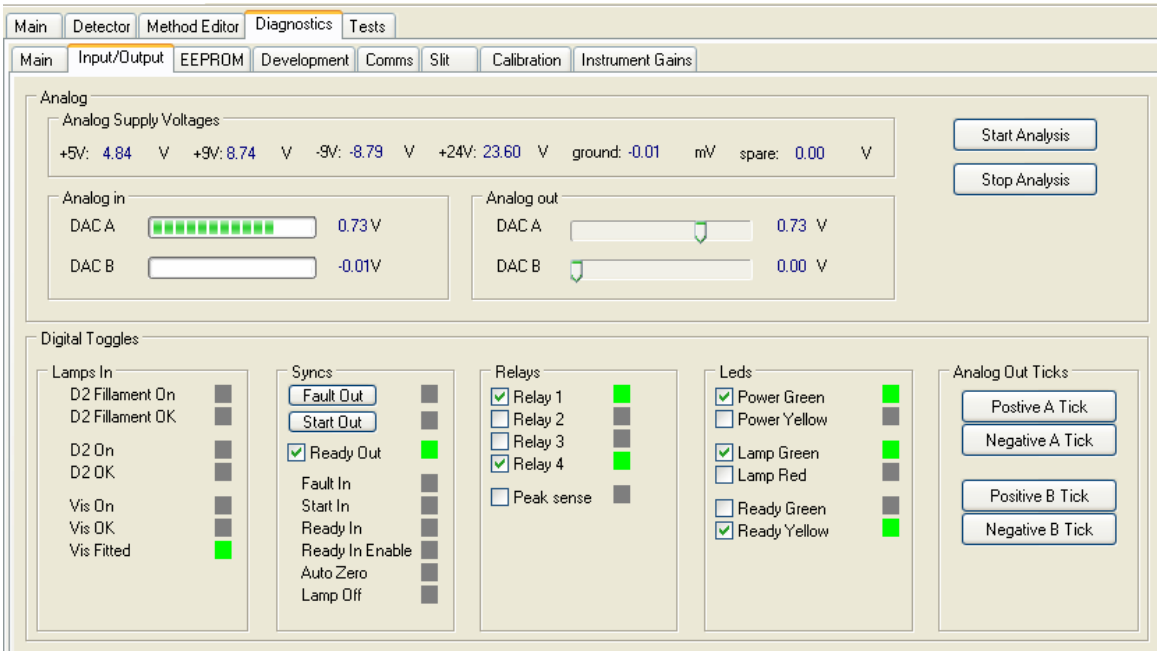


There are two very important parts of this page. The **Cell Parameters** section tells the detector the type of flow cell that is installed and is critical to the integrity of the results that are obtained from the detector. Always ensure that the correct cell type is entered here.

The **Enter Diagnostic State** check box should not be checked. Do not attempt to put the 335 into diagnostic state. There are no post-factory tests that need the 335 in Diagnostic state.

Input/Output

The Input/Output sub-tab is a very useful diagnostic tool that can be used to check any analog voltage or digital state that the detector can provide.



Analog Supply Voltages - Used to view power supply voltage levels coming from the two rear power supplies PS1 & PS2. These measurements are performed by the ADC circuits on the main processor PWB.

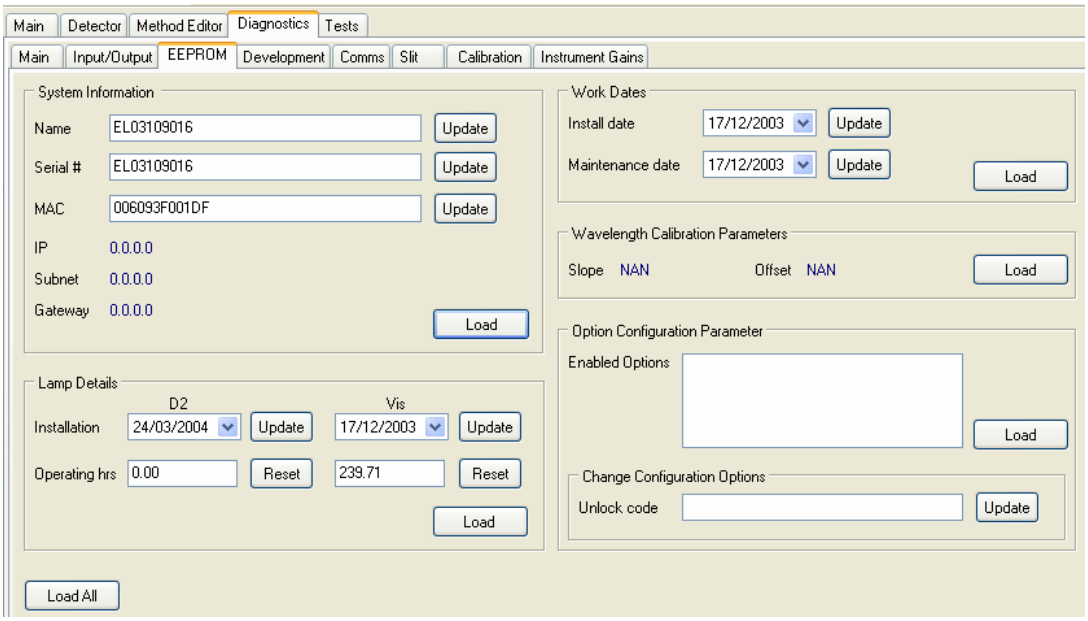
Analog In – To verify the Analog input and output circuits (DAC A & DAC B), set the sliders on the two Analog out controls to any value and click Start Analysis. The real voltage generated by the detector is then displayed in the corresponding Analog in (DAC A & DAC B) fields.

Digital Toggles – Used to verify the operation of the Sync signals located at the rear of the detector. Toggle any signal by clicking in its tick box and then monitor it at the output either on the D-range connector pin, or on the Rear Panel Interface PWB if fitted.
The five detector relays can be individually toggled to verify their operation as well as checking the bi-color status of each of the three front panel LED's.

EEPROM

Use this page to view and reset the information contents of the EEPROM. From here you can reset the dates and operating hours whenever installing a new lamp source, as well as the installation and maintenance dates for the detector.

Publication date: April 2004



Clicking on “Load” will display the current EEPROM information for the detector you are connected to. This can be done individually, such as in the Lamp Details section, or you can click “Load All” to display the entire contents from all sections on the page.
To make an entry into the EEPROM, enter in the desired information into the appropriate field and click on “Update”.

System Information – Displays the Name, Serial Number and TCP\IP parameters for the detector. You can change the name of the detector by updating the name field and clicking the Update button.

WARNING: Do not include brackets “( )” in the name of the detector, i.e. “My (PDA) Detector”. Brackets will cause serious problems with the detector connection to the LAN and, PolyDiagnostics will to not display the detector when the Discover button is pressed. The same applies to ProStar 325 UV/Vis Detectors.

WARNING: Do not change the MAC address of the detector under any circumstances.

Lamp Details – This section displays the operating hours for each lamp installed in the detector. If a new lamp is installed, press the Reset button to start the lamp hour counter to zero.

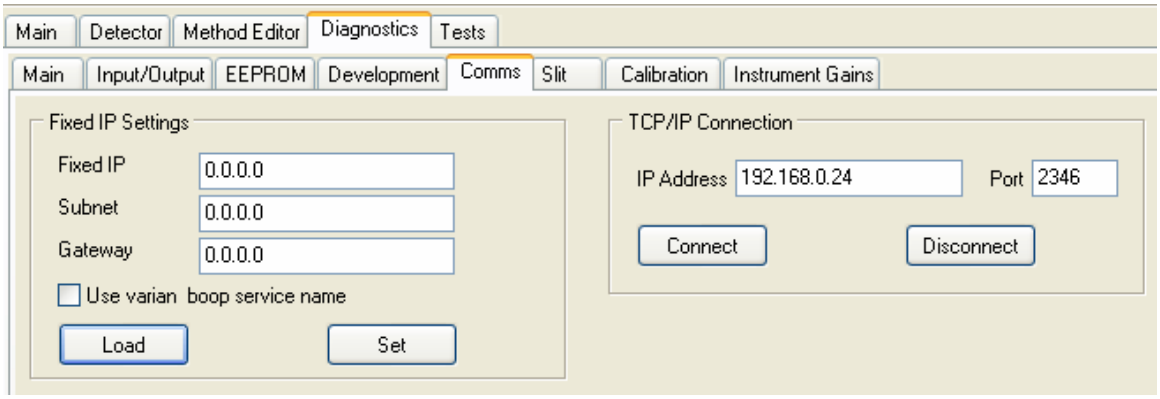
Work Dates – Allows you to keep track of important dates, like the detectors installation date.

Wavelength Calibration Parameters – (slope) this is a correction factor that is mathematically applied to help maintain wavelength accuracy of the optics. It eliminates any inaccuracies in wavelengths caused by mechanical errors such as grating squareness. The D2 emission line at 656.1nm is a strong signal and is well characterized.
It is widely used in UV-Vis spectroscopy as an accurate wavelength marker. The detector performs a search for this emission line, and then does a search for 0nm. A correction factor is then applied between these two points. This will ensure that these two emission lines are accurately identified and ‘placed’ in their correct spectral position. All wavelengths can therefore be deemed as accurate.

Change Configuration Options – Not used for the 335.

Comms

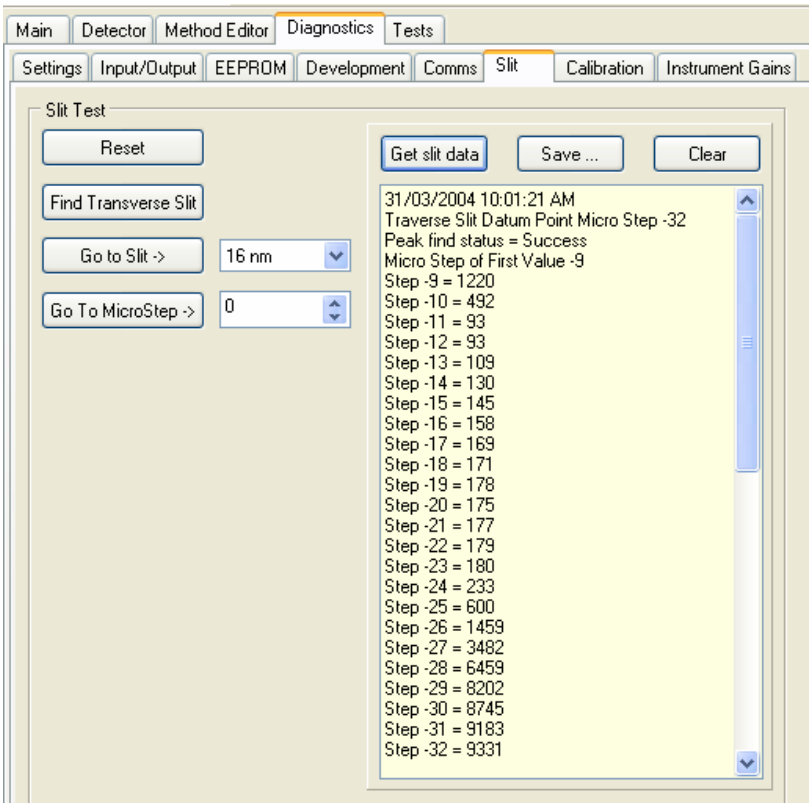
The Comms sub-tab is used to manage the TCP\IP connections to the detector.



Fixed IP Settings – Used to manually assign an IP address, subnet & gateway settings. Enter the details in the desired fields then click “Set”. These details can also be uploaded from the detector by clicking on “Load”. These settings may only need to be used, if the network that the detector is connected to isn’t managed by a bootp server.

TCP/IP Connection – If you know the unique IP address of the detector you wish to connect to, enter in the address and click “connect”. This is a direct method of connection and is an alternative to using the ‘Discover’ method.

Slit



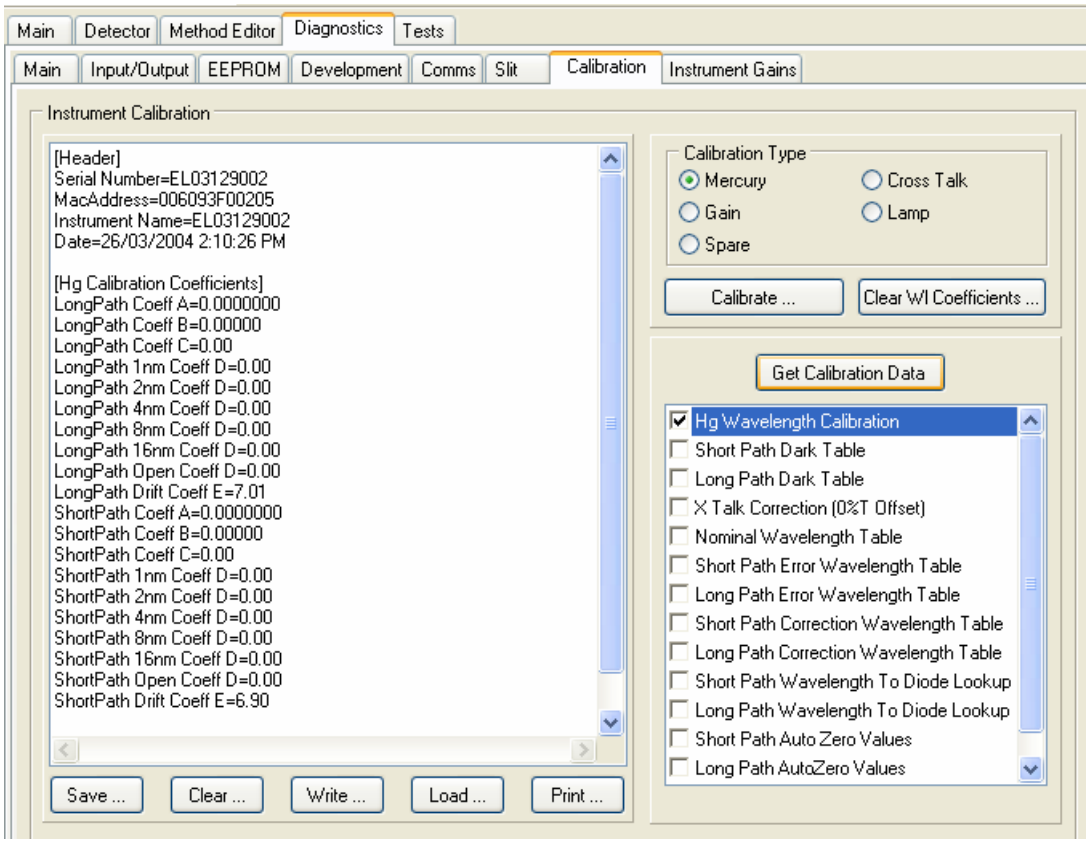
Publication date: April 2004

The Slit sub-tab allows you to check the operation of the slit alignment routine. Each slit is automatically aligned to maximize the amount of light that reaches the array. The slit offset values can be retrieved by the Get slit data button.

A typical value for the Traverse Slit Datum Mictor Step is -32.

Calibration

The Calibration sub-tab contains a set of commands to retrieve calibration data from the detector. The detector can also be calibrated from this window.



7.3 Detector Calibration

This section is used to display the current calibration values stored in the detector. It is also possible to edit the current values and download new values to the detector's EEPROM.

If the optics module needs to be replaced, the new module will be supplied with a disk containing important calibration data that is specific to that module. To load the data, click the Load... button and select the calibration file. The new calibration values will now appear in the text box (as shown above) indicating that the download is complete.

If the current calibration values need to be retrieved from the detector and sent to the factory for analysis:

1. Click the Clear button at the bottom of the text box to clear the previous text stored in the box.
2. Click the appropriate fields in the Get Calibration Data section and then click the Get Calibration Data Button. This will load the calibration values into the text box.
3. Click the Save button at the bottom of the text box and select a directory to save the calibration file in.

Calibration Type

Mercury - A wavelength calibration that is performed with a Mercury lamp in place of the D2 lamp. It is the main wavelength calibration that is performed by the factory on every optics module. If a new optics module needs to be replaced, a disk containing this calibration data is supplied and must be downloaded to the detector as described in the previous section. If the existing module needs to be recalibrated, the Mercury wavelength calibration can be performed.

To perform a Mercury calibration:

1. Remove the D2 lamp and install the supplied Mercury lamp according to the instructions provided in the calibration kit.
2. Turn only the D2 lamp on and wait 10min for the emission wavelengths to stabilize.
3. Click the Mercury check box in the Calibration Section of the window.
4. Click Calibrate... and wait until the detector completes the calibration.
5. Turn off the Mercury lamp and reinstall the D2 lamp.

Note: The Clear WI Coefficients button should only be used if a Mercury lamp calibration has been performed accidentally while the D2 lamp is in the detector (and a Mercury lamp is not available to correct the error). The Clear WI Coefficients function will clear the detectors memory of the incorrect values and reset to default values.

Gain – The Gain calibration is used to adjust the detector gain associated with each slit width.

Cross Talk – Similar the 0%T calibration in the ProStar 325, except that a piece of black paper does not need to be used to block the sample beam. The 335 has a slit setting that blocks the sample beam automatically during this test.

Lamp – The Lamp calibration is a combination of the Gain and Cross Talk calibrations and is the only type that should be used unless there are exception circumstances (eg. The optics module is replaced).

Spare – This option is not used.

Detector Gains

The Detector Gains sub-tab is used to retrieve data from the gain tables of the detector. The gain tables store data that tell the PGAs to changes their gain depending on the slit setting.

This function is normally only used for development purposes but can indicate whether there are errors in the optics module. The data that will be displayed via the Get Detectors Gain button will differ depending on the type of detector (single or dual array) used.

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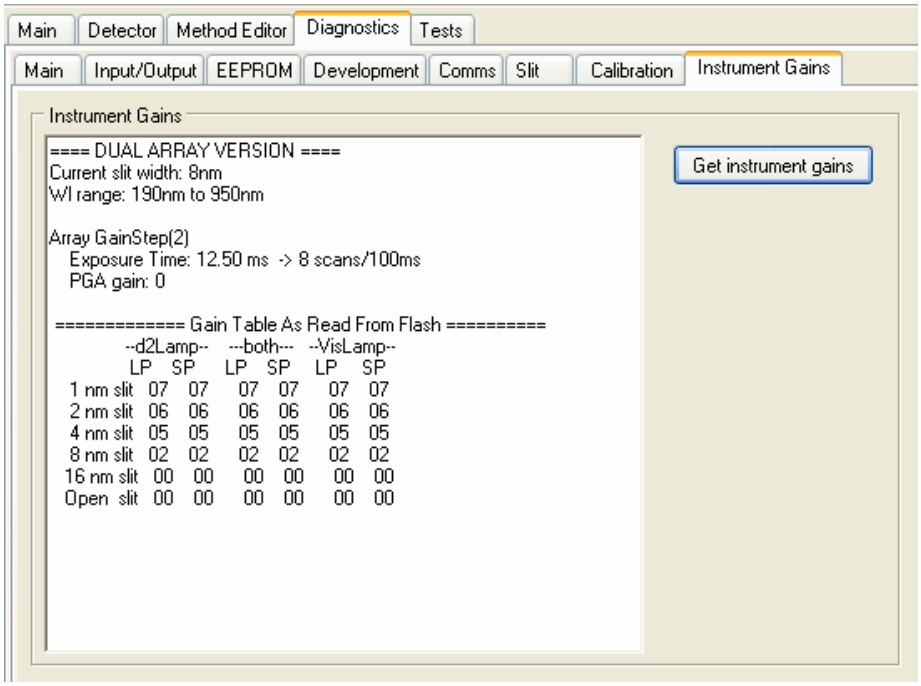
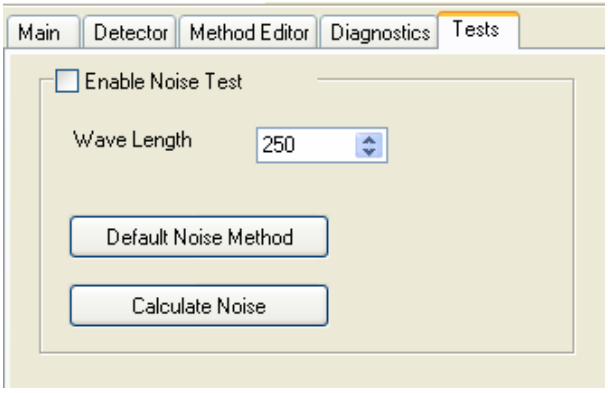


The gain table (above) shows the gain increasing as the slit width gets smaller. This indicates that the gain settings are correct. If the gain is zero or very high for each slit width, there is a problem with the optics module or main board.

Tests Tab

The Tests tab is only used to run a custom noise test on the detector. This was used for development proposes and is not equivalent to the OQ noise test.

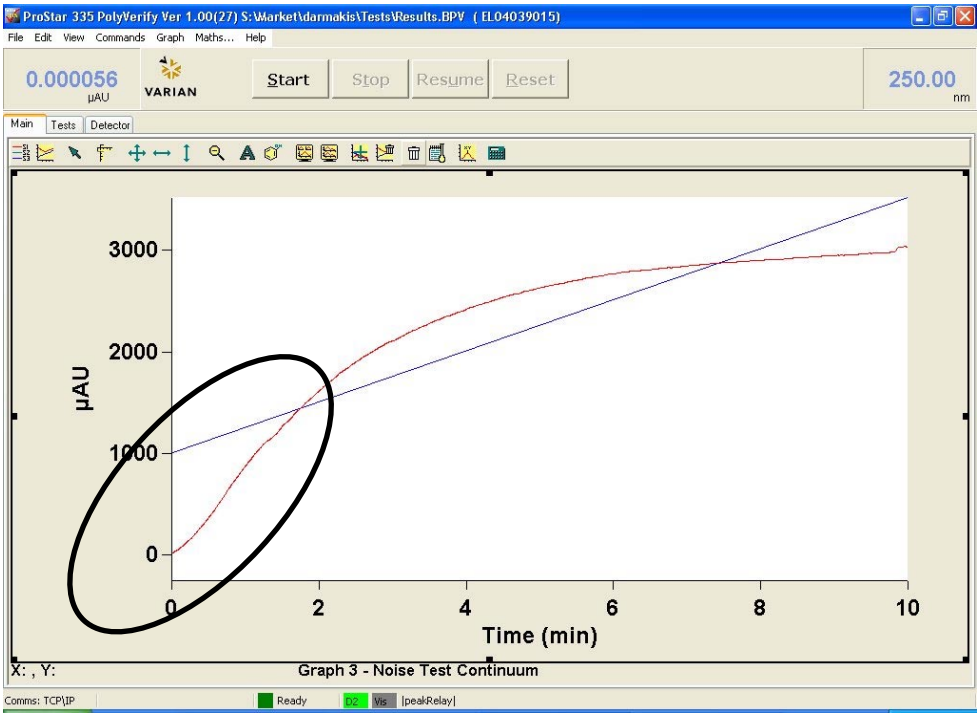


7.4 Verify – what to do when installation tests fail

The following is a trouble shooting guide for when an installation test has failed. Only the two installation tests are covered.

7.4.1 Noise/Drift test

Below is an example of a failed Noise/Drift test. The failure in this instance was caused by the slight drift seen at the beginning of the trace. When the Y-axis scale has the uAU shown in the 1000's range, then the test will most likely fail.



After starting the noise test, if you see this initial drift pattern starting to occur, then the test will most likely fail. Stop the test and re-start it again. You must select “Reset” from the main tool bar prior to pressing “Start” again.

Cause	Solution
A primary cause for this initial drift is detector warm up.	Allow at least an hour warm up, with both lamps on, for the detector to stabilize before running this test.
Flowcell is not seated correctly and one of the two beams is being clipped.	Re-seat the flowcell according to instructions given in this manual. This will ensure a good gain calibration is carried out when a “Lamp On” command is received.
Perform a lamp calibration.	A lamp calibration will re-adjust the gain settings used for each slit position. A calibration every six months will adjust the settings to reflect the loss of light throughput from an ageing lamp. Refer to Electronics section for details.
Ageing deuterium lamp.	If the above measures have been tried but proven unsuccessful, then the deuterium lamp may need replacing.

A good example of a successful test is shown below. The peak-peak noise is very low compared to the example above. The Y-axis scale is in the tens of uAU and not in the 1000’s.

The line drawn across the noise spectrum is the signal average and is the final result derived from this test.

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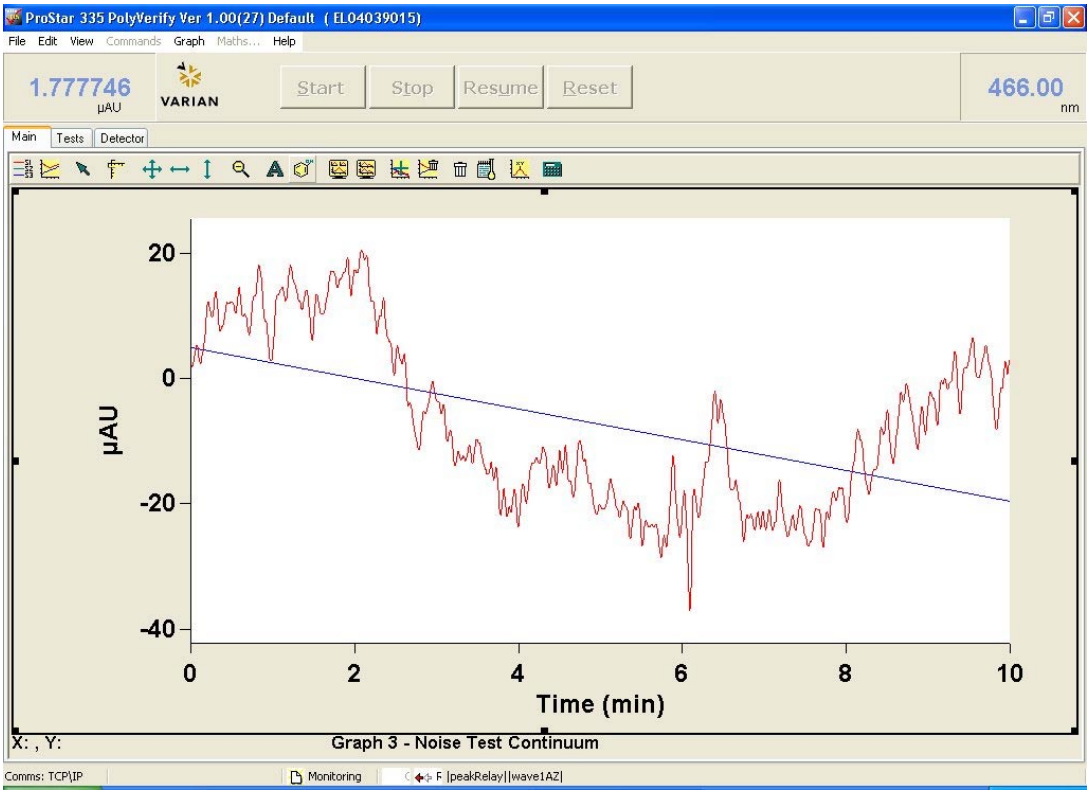
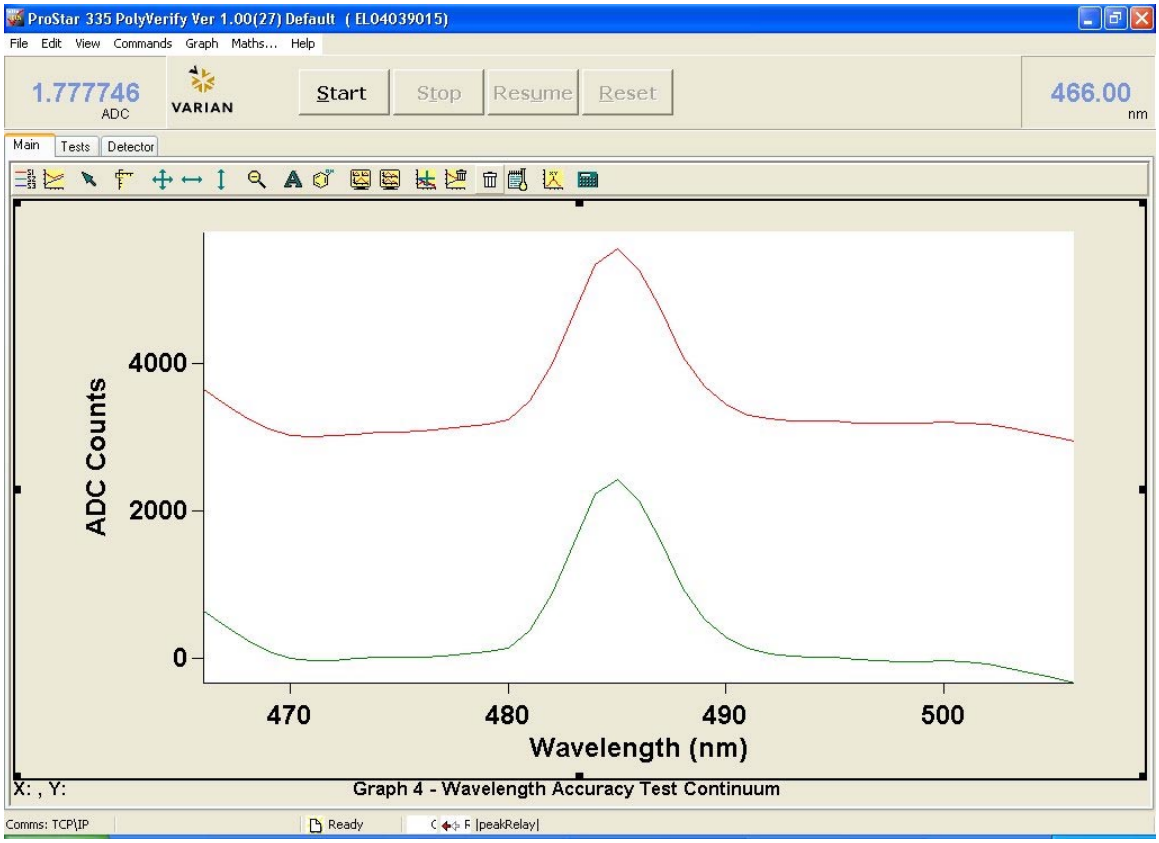


7.4.2 Wavelength Accuracy

Below is an example of the wavelength accuracy test passing. It performs to single beam scans and takes an average of the two peak positions.



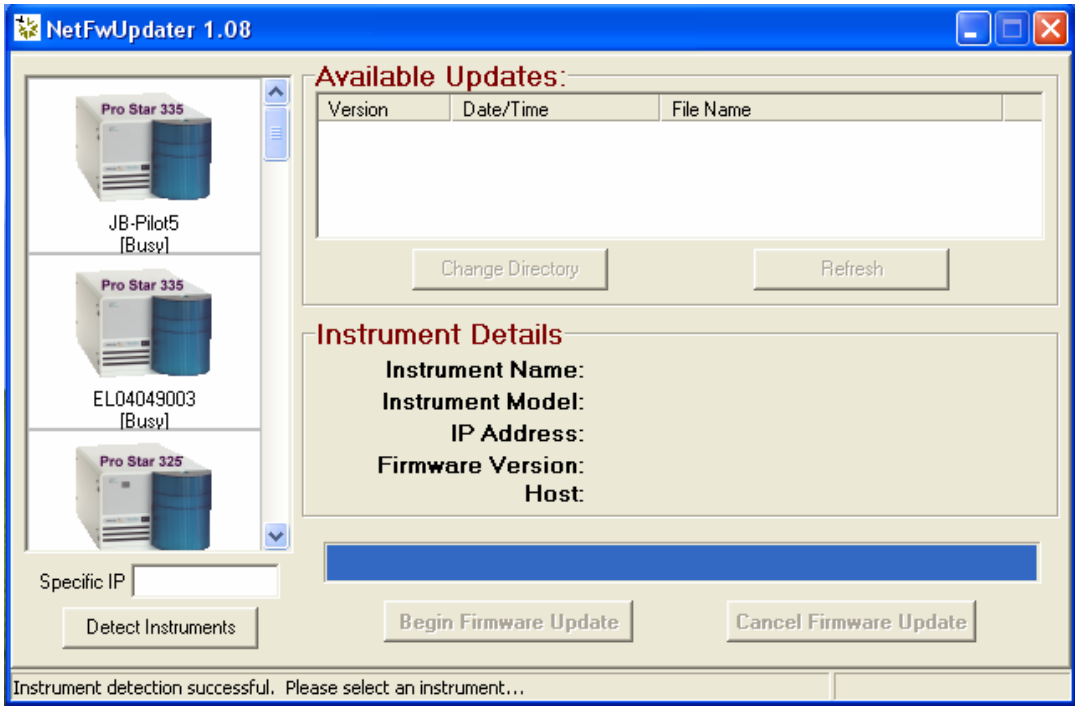
Cause	Solution
Flowcell is not seated correctly.	Re-seat the flowcell as according to instructions given in this manual.
Wavelength has drifted.	Re-initialize the detector.
EEPROM data may be corrupt.	Reload the optics module wavelength calibration factors into the EEPROM. Refer to Diagnostics section.
Possible optical alignment problem.	Replace optics module.

7.4.3 Updating detector firmware

Updates and enhancements to firmware code occur often. To update the detector firmware when an upgrade becomes available, use the a program called “NetFwUpdater” and follow the procedure below.

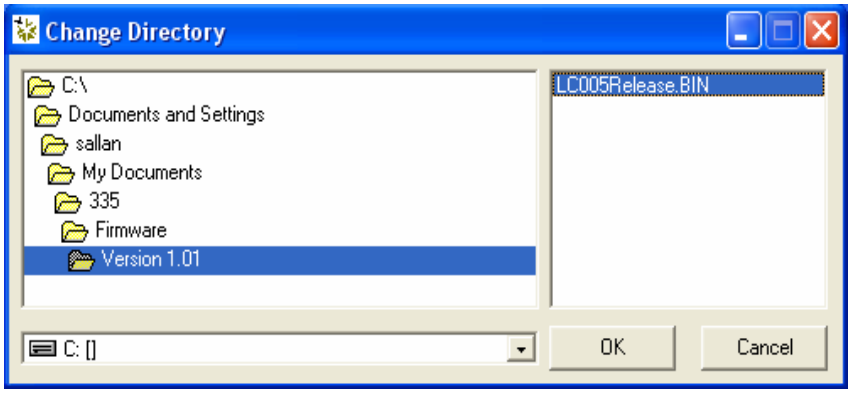
1. Execute the NetFwUpdater Program by double clicking it. The screen below will appear.
2. Use the vertical scroll bar to locate the picture of the detector you are going to update. If there are both ProStar 325 and 335 detectors on the network, distinguish between the two types by reading the purple labels on the pictures of the detectors.
3. Highlight the detector with a single click of the mouse.

Note: You can also locate the detector by typing in its IP address in the box below the scroll bar.

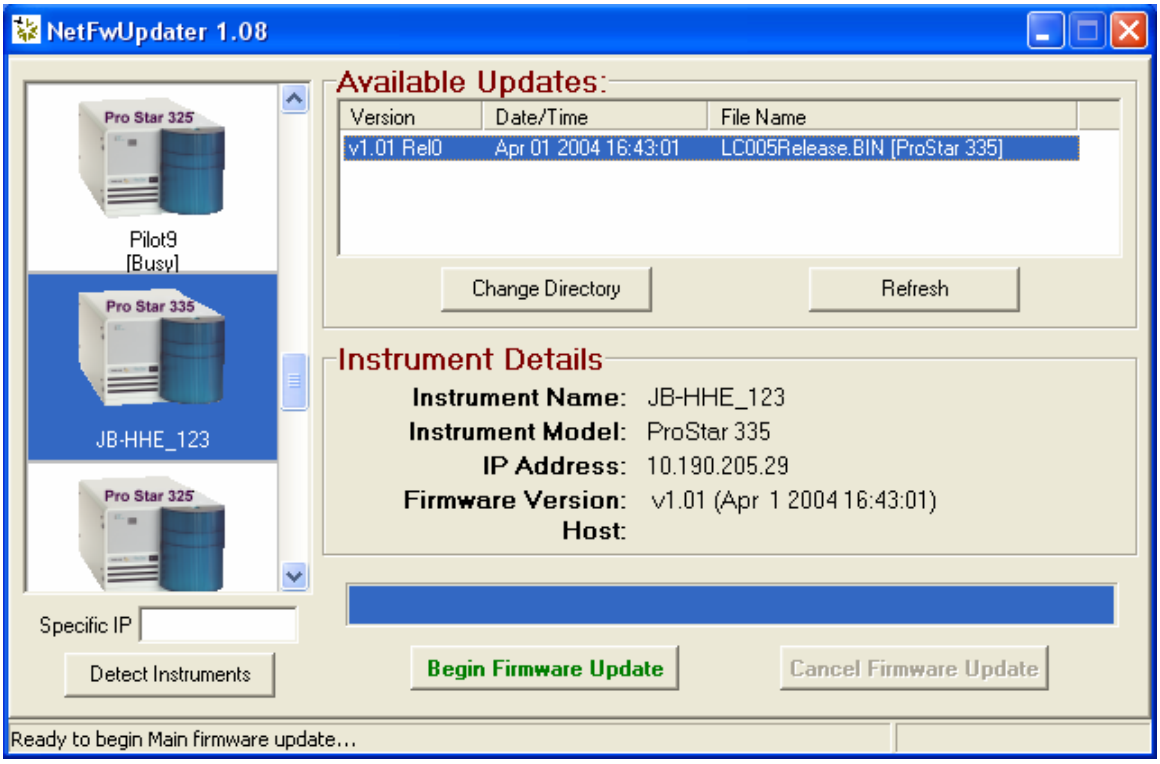


4. To select the firmware to download to the detector, click the “Change Directory” button.

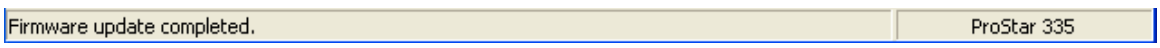
5. Select the directory where the firmware update is located in and click the OK button.



6. The main screen will now show the list of updates in that directory (if more than one firmware update is located in the directory, the most recent update will be on the top of the list).



7. Highlight the new firmware file and click the Begin Firmware Update button. When the update is completed the NetFwUpdater program can be closed.



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Publication date: April 2004

8 Error messages

The ProStar 335 detector can detect a wide variety of error conditions and report them to the PC. These errors can be a direct reaction to command messages from the PC, such as parameter range problems, while other errors can be generated during a scan or during routine operation.

Severity Code	Numeric Code	Description
Fatal	0xc000	Indicates a serious error that compromises the ability of the detector to respond to future commands. The PC is free to continue sending commands which will be handled as best it can. The results however should not be trusted and the detector should be Reset.
Error	0x8000	Indicates that a command from the PC cannot be executed, or a problem has risen that will invalidate the results of the current scan. The detector gives the appearance it is still functioning correctly.
Warning	0x4000	A minor type of error where some unexpected or unwanted event has occurred. These errors should not significantly affect operation. They are logged and reported to the user.
Information	0x0000	This is not actually an error, but some unusual event has occurred. This type of error should not generally be reported to the user but is logged and dealt with in software.

9001 SYS_CC_CMD_INVALID_IN_POWERON_STATE
Command is not valid in the POWER ON state

9002 SYS_CC_CMD_INVALID_IN_NOTREADY_LAMP_OFF_STATE Command is not valid in the NOT READY LAMP OFF state

9003 SYS_CC_CMD_INVALID_IN_NOTREADY_LAMP_ON_STATE Command is not valid in the NOT READY LAMP ON state

9004 SYS_CC_CMD_INVALID_IN_INITIALISE_STATE Command is not valid in the INITIALISE state

9005 SYS_CC_CMD_INVALID_IN_MONITOR_STATE Command is not valid in the MONITOR state

9006 SYS_CC_CMD_INVALID_IN_READY_STATE
Command is not valid in the READY state

9007 SYS_CC_CMD_INVALID_IN_RUNNING_STATE Command is not valid in the RUNNING state

9008 SYS_CC_CMD_INVALID_IN_STOPPED_STATE
Command is not valid in the STOPPED state

9009 SYS_CC_NOT_A_VALID_COMMAND TUCKERBAG ERROR CODE - USEABLE IF NECESSARY

9010 SYS_CC_CMD_NOT_IMPLEMENTED_YET TUCKERBAG ERROR CODE - USEABLE IF NECESSARY

9011 SYS_CC_TOO_MANY_BYTES
TUCKERBAG ERROR CODE - USEABLE IF NECESSARY

9012 SYS_BUFFER_TOO_SMALL
a detector buffer used in a function was too small to complete the function. (log as firmware bug: recording the command (function) which caused the error to appear)

9013 SYS_CC_NOT_VALID_RELAY
Attempt to change state of an invalid Relay

9014 SYS_CC_CMD_INVALID_IN_CALIBRATION_STATE Command is not valid in the CALIBRATION state

9053 SYS_CC_ACCESS_TO_VID_NOT_ALLOWED
Write access to some of the NonVolatile storage locations is not permitted. This error indicates an attempt to write to one of those protected locations.

9054 SYS_CC_ENCRYPT_ERROR_READING_SERIAL_NO Detector needed to check the serial number for some de-encryption procedure, the read of the serial number fromEEPROMfailed

9055 SYS_CC_ENCRYPT_ERROR_WRITING_OPTIONS Detector needed to write configuration options to EEPROM. The write toEEPROMhas failed.

9062 SYS_CC_INVALID_FOR_SINGLE_ARRAY_DETECTOR Command invalid in detectors with a single array. Indicates an attempt to perform a Dual Array specific command on a Single array detector.

9101 COM_CC_NO_RUNDATA_AVAILABLE
Informs the client application upon request for run data, that run data is not available at this time.

9102 COM_CC_END_OF_METHOD
Informs the client application that there is no more run data, and the method just finished.

9104 COM_CC_UNKNOWN_DIAG_SUB_COMMAND
Received a Diagnostic command with an unknown sub command, (Client application bug).

9105 COM_CC_MESSAGE_LENGTH_INVALID
Generic message that the client application did not encode the command (and associated length) correctly (Client application bug).

9106 COM_CC_UNKNOWN_LOG_TYPE
Request to clear a unknown detector log (client application bug).

9107 COM_CC_REBOOT_CODE_DOES_NOT_MATCH
The code in a command to reboot the detector does not match. This is either an application error, or a error in decoding the TCP/IP stream (possibly an error of excessive bytes in the previous message).

9108 COM_CC_METHOD_CHANGED_DURING_READ
Notify the client that during the reading phase of a method, an external source has changed the method. It is the client applications responsibility to restart the reading of the method.

9109 COM_CC_BOOTP_SNAME_NOT_VALID
The BootPSName field in SetIpParams is invalid (Client application bug).

9110 COM_CC_GATEWAY_NOT_ON_SAME_SUBNET
The gateway specified in SetIpParams has to be on the same subnet as the detector IP specified in the same command.

9144 COM_CC_NO_MORE_STRINGS_END_OF_ARRAY
Inform client he has retrieved all the RunLog or ErrorCode strings available in the detector.

9119 COM_CC_NO_CALIBRATE_TIMES_TO_RETURN
The detector could not find any valid calibration times to return.

COM's/FLASH PROGRAMMING ERRORS

9150 FLASH_CC_COMMIT_ERASED_SECTOR
Flash Programming Info:

9151 FLASH_CC_COMMIT_ERASE_ERROR
Either Sector specified is greater than the number of sectors in device, or the status of flash is bad.

9153 FLASH_CC_COMMIT_PROGRAM_ERROR
Failed to commit data to flash. Possible cause is Flash device not identified or status of programming data is not valid.

9154 FLASH_CC_FLASH_NOT_FOUND
INTERNAL, firmware cannot find flash for programming.

9155 FLASH_CC_COMMIT_NEED_PASSWORD
Application did not send password to unlock flash.

9156 FLASH_CC_COMMIT_ALL_PROG_OK
Commit to flash was successful.

9161 FLASH_CC_FLASH_ABORTED_DOWNLOAD
Flash Programming Warning.

9162 FLASH_CC_DNLD_ADDR_OUT_OF_RANGE
The address as specified by download program is outside the RAM image area.

9163 FLASH_CC_PROG_TOP_ADDR_RANGE
The starting address of location to flash and the image size of the data to flash ends on an address higher than the top of flash memory.

9164 FLASH_CC_FLASH_PROG_BOTTOM_ADDR_RANGE
Flash Programming Error.

9165 FLASH_CC_UNKNOWN_BLOCK_SELECTED
The block specified to be flashed is unknown by the firmware.

9166 FLASH_CC_REQ_TOO_MANY_BYTES__TRUNCATED Request to read too many bytes from the flash, so the returned data has truncated the bytes to the maximum allowed.

9167 FLASH_CC_REQ_ZERO_BYTES_NEED_AT_LEAST_ONE Request to read data from the flash, but the requested length is 0, .. must have at least 1 byte.

9168 FLASH_CC_PARAMETER_BLOCK_FULL
Separate parameter block in flash file system is full and cannot store any more parameters until file system has been erased.

9169 FLASH_CC_PARAMETER_CRC_BAD
Stored CRC does not match calculated CRC, or could not find stored CRC from index and tag, or the retuned location from index and tag is outside valid area.

9170 FLASH_CC_PARAMETER_WRITE_FAILED
Error writing parameters due to not finding device or other flash status error.

9171 FLASH_CC_PARAMETER_ALREADY_EXISTS
Request to overwrite an existing parameter without the overwrite flag turned on.

9172 FLASH_CC_PARAMETER_DOES_NOT_EXIST
Request to read a parameter that does not exist in the file system.

9173 FLASH_CC_PARAMETER_DELETE_FAILED
Failed to delete parameter due to device not found or some other flash status word problem.

9174 FLASH_CC_PARAMETER_BLOCK_ERASE_FAILED
Failed to erase the entire block due to a sector being outside allowed range or some other flash status word problem.

9175 FLASH_CC_PARAMETER_BYTES_REQ_NO_MATCH
Bytes requested does not match number bytes stored.

9176 FLASH_CC_PARAMETER_NULL_POINTER_SENT
Request to copy parameters to flash but the pointer to the parameters is NULL, .. no copy performed.

9177 FLASH_CC_RQSTD_READ_PAST_MEM_TOP
Request to read parameters that go past the top of memory.

9178 FLASH_CC_PARAMETER_SIZE_TOO_LARGE
Block size in bytes of the parameter is too large to write.

9179 FLASH_CC_PARAMETER_TAG_RANGE
Tag number of block to write or read is outside defined range.

9200 SIG_CC_CELL_RATIO_AND_TYPE_DONT_MATCH
Extended range cells 9x1 and 4x.15 as well as a Special development cell have expectations of valid cell ratios. This indicates to the client application, and to the user, that the numbered entered in Cell ratio is outside allowed range for cell type (if cell not within these defined ratios then cell is not within cell specifications).

9211 SIG_CC_RESET_NORMALISE_FEATURE
Information message to client application, indicating the cell normalize feature that was turned on has been reset to “off”. This is due to changing to a cell that does not support normalization.

9223 SIG_CC_SLIT_PEAK_NOT_FOUND
Not successful at finding the traverse slit peak. Detector can safely power up using the slit position from the last successful slit calibration (stored in EEPROM) or the Default position (microstep = -32) if EEPROM location invalid.

9224 SIG_CC_SLIT_IS_NOT_CALIBRATED
Request for slit calibrate data before slit has been calibrated, therefore no data to return.

MERCURY LAMP WAVELENGTH CALIBRATION ERRORS

9225 SIG_CC_WAVE_CAL_NO_MERCURY_LAMP_DETECTED **9226** SIG_CC_WAVE_CAL_NO_PEAK
9227 SIG_CC_WAVE_CAL_NO_PEAK_AT_253.6nm
9228 SIG_CC_WAVE_CAL_NO_PEAK_AT_546.1nm
9229 SIG_CC_WAVE_CAL_NO_PEAK_AT_912.3nm

9232 SIG_CC_WL_CAL_NO_SP_THRESHOLD_LO_AT_253.6nm During calculation of the Short Path 253.6nm the threshold was detected as being too low, therefore wavelength calibration aborted.

9233 IG_CC_WL_CAL_NO_SP_THRESHOLD_LO_AT_546.1nm
During calculation of the Short Path 546.1nm the threshold was detected as being too low, therefore wavelength calibration aborted.

9234 SIG_CC_WL_CAL_NO_SP_THRESHOLD_LO_AT_912.3nm
During calculation of the Short Path 912.3nm the threshold was detected as being too low, therefore wavelength calibration aborted.

9235 SIG_CC_WL_CAL_NO_SP_THRESHOLD_HI_AT_253.6nm During calculation of the Short Path 253.6nm the threshold was detected as being too high, therefore wavelength calibration aborted.

9236 SIG_CC_WL_CAL_NO_SP_THRESHOLD_HI_AT_546.1nm
During calculation of the Short Path 546.1nm the threshold was detected as being too high, therefore wavelength calibration aborted.

9237 SIG_CC_WL_CAL_NO_SP_THRESHOLD_HI_AT_912.3nm
During calculation of the Short Path 912.3nm the threshold was detected as being too high, therefore wavelength calibration aborted.

9238 SIG_CC_WL_CAL_NO_LP_THRESHOLD_LO_AT_253.6nm During calculation of the Long Path 253.6nm the threshold was detected as being too low, therefore wavelength calibration aborted.

9239 SIG_CC_WL_CAL_NO_LP_THRESHOLD_LO_AT_546.1nm During calculation of the Long Path 546.1nm the threshold was detected as being too low, therefore wavelength calibration aborted.

9240 SIG_CC_WL_CAL_NO_LP_THRESHOLD_LO_AT_912.3nm During calculation of the Long Path 912.3nm the threshold was detected as being too low, therefore wavelength calibration aborted.

9241 SIG_CC_WL_CAL_NO_LP_THRESHOLD_HI_AT_253.6nm During calculation of the Long Path 253.6nm the threshold was detected as being too high, therefore wavelength calibration aborted.

9242 SIG_CC_WL_CAL_NO_LP_THRESHOLD_HI_AT_546.1nm During calculation of the Long Path 546.1nm the threshold was detected as being too high, therefore wavelength calibration aborted.

9243 SIG_CC_WL_CAL_NO_LP_THRESHOLD_HI_AT_912.3nm During calculation of the Long Path 912.3nm the threshold was detected as being too high, therefore wavelength calibration aborted.

9244 SIG_CC_LONG_PATH_190_NM_BELOW_DIODE_0
This error occurs when the Long path 190nm end of spectrum falls off the array and only occurs at the end of a wavelength calibration. This error does affect the performance of the detector and is intended to highlight to that the calibration is not satisfactory or some optical alignment is required.

9245 SIG_CC_LONG_PATH_950_NM_ABOVE_DIODE_1023 This error occurs when the Long path 950nm end of spectrum falls off the array and only occurs at the end of a wavelength calibration. This error does affect the performance of the detector and is intended to highlight to that the calibration is not satisfactory or some optical alignment is required.

9246 SIG_CC_SHORT_PATH_190_NM_BELOW_DIODE_0
This error occurs when the Short path 190nm end of spectrum falls off the array and only occurs at the end of a wavelength calibration. This error does affect the performance of the detector and is intended to highlight to that the calibration is not satisfactory or some optical alignment is required.

9247 SIG_CC_SHORT_PATH_950_NM_ABOVE_DIODE_1023
This error occurs when the Short path 950nm end of spectrum falls off the array and only occurs at the end of a wavelength calibration. This error does affect the performance of the detector and is intended to highlight to that the calibration is not satisfactory or some optical alignment is required

9248 SIG_CC_190_NM_AND_950_NM_OUTSIDE_LP_ARRAY
This error occurs when the Long paths have both ends of the spectrum falling off the array and it only occurs at the end of a wavelength calibration. This error does affect the performance of the detector and is intended to highlight to that the calibration is not satisfactory or some optical alignment is required

9249 SIG_CC_190_NM_AND_950_NM_OUTSIDE_SP_ARRAY (9249+ERR)
//!< This error occurs when the Short path have both ends of the spectrum falling off the array and only occurs at the end of a wavelength calibration. This error does affect the performance of the detector and is intended to highlight to that the calibration is not satisfactory or some optical alignment is required

9250 SIG_CC_WAVELENGTHS_OUTSIDE_ARRAYS_ON_BOTH_PATHS
This error occurs when the both paths have both ends of the spectrum falling off the array. It only occurs at the end of a wavelength calibrate. This error does affect the performance of the detector and is intended to highlight to that the calibration is not satisfactory or some optical alignment is required

9251 SIG_CC_WL_CAL_LP_COEFFS_EEDATA_BAD
Long path wavelength calibration coefficients read from EEPROM are bad. Consider the detector uncalibrated in the Long path.

9252 SIG_CC_WL_CAL_SP_COEFFS_EEDATA_BAD
Short path wavelength calibration coefficients read from EEPROM are bad. Consider the detector uncalibrated in the Short path

9253 SIG_CC_CURRENT_GAIN_FACTORS_BAD
When the gain factors are less than 0.8, they can be considered bad. These do not affect performance in Abs mode, and are used for internal diagnostic functions only.

9254 SIG_CC_SCALING_FACTOR_INVALID
The scaling factor provided is not within the valid range of scaling factors.

9256 SIG_CC_LP_DIODE_ARRAY_FILTER_IS_MISSING
Long Path test for 2nd Order filters on the array. This test checks the ratio between the first harmonic and 2nd harmonic of a peak and if the ratio is above a certain limit then the 2nd Order filter is missing.

9257 SIG_CC_SP_DIODE_ARRAY_FILTER_IS_MISSING
Short Path test for 2nd Order filters on the array. This test checks the ratio between the first harmonic and 2nd harmonic of a peak and if the ratio is above a certain limit then the 2nd Order filter is missing.

9258 SIG_CC_BOTH_DIODE_ARRAY_FILTERS_ARE_MISSING Short Path test for 2nd Order filters on the array. This test checks the ratio between the first harmonic and 2nd harmonic of a peak and if the ratio is above a certain limit then the 2nd Order filter is missing.

9259 SIG_CC_LP_ARRAY_FILTER_TEST_DIV_ZERO_ERROR
Bad result for test divide by zero used in 2nd Order filters.

9260 SIG_CC_SP_ARRAY_FILTER_TEST_DIV_ZERO_ERROR
Bad result for test divide by zero used in 2nd Order filters.

9261 SIG_CC_INVALID_CELL_
The cell type in SetCellParams is invalid (client application bug).

9262 SIG_CC_0T_CAL_DATA_READ_SIZE_WRONG
0%T Calibrate data size is wrong as read from FLASH. May be corrupt.

9264 SIG_CC_0T_DIODE_AVG_SBW_DIV_ZERO
Slit BW=0 in 0%T diode avg. - would cause divide by zero error.

9265 SIG_CC_0T_CAL_WRONG_DATA_VERSION
Old Version of data in FLASH - recalibration is required.

9268 SIG_CC_REPERFORM_Hg_WL_CALIBRATE_FW_CHANGE
The Mercury Calibration needs to be re-performed. The detector is running uncalibrated

9269 SIG_CC_DETECTOR_CURRENTLY_NOT_WL_CALIBRATED Warning message to inform detector is currently not wavelength calibrated.

9270 SIG_CC_REPERFORM_LAMP_CALIBRATE_FW_CHANGE Lamp calibration needs to be re-performed due to changes in the firmware structure or algorithm.

9271 SIG_CC_REPERFORM_LAMP_CALIB_STRUCTURE_CHANGE Lamp calibration needs to be re-performed due to changes in the firmware structure.

9272 SIG_CC_SIGNAL_OVERRANGE_REPERFORM_LAMP_CAL Lamp Calibration needs to be re-performed, and overrange signal was detected.

9285 SIG_CC_AUTOZERO_OVERRIDE_INVALID_VALUE
The value sent down to override the AutoZero collection is neither Enabled or Disabled.

9286 SIG_CC_REWRITE_HG_CAL_FAILED
The attempt to rewrite the Hg wavelength calibration has failed. After receiving this error the WL calibration will be in an unknown state until another WL calibration is performed or a successful rewrite of previous WL calibration data is accomplished.

9300 SEQ_CC_VERIFIY_MONO_CAL_FAILED

9301 SEQ_CC_REFUSE_CAL_AS_ZERO_ORDER_FAILED

9302 SEQ_CC_MONO_CAL_SLOPE_OUTSIDE_LIMITS

9303 SEQ_CC_MONO_CAL_CANNOT_FIND_D2_PEAK

9304 SEQ_CC_MONO_CAL_D2_OFF_OR_VIS_ON

9305 SEQ_CC_MONO_CAL_EEPROM_ERROR_READ_SLOPE

9306 SEQ_CC_MONO_CAL_EEPROM_ERR_WRITE_SLOPE

9307 SEQ_CC_MONO_CAL_EEPROM_ERR_WRITE_OFFSET

9308 SEQ_CC_NOT_IN_DIAG_STATE_CANNOT_EXIT

9309 SEQ_CC_NOT_VALID_CALIB_ALREADY_RUNNING Request to perform a calibration when one is already running. This is explicitly disallowed.

9402 MST_CC_HEADER_WAVELENGTH_MODE_INVALID

9403 MST_CC_HEADER_SIGNAL_MODE_INVALID

9404 MST_CC_HEADER_ANA_1_SOURCE_INVALID MethodHeader error: the field "Analog1 Source" contains an invalid value. Possible cause is client application.

9405 MST_CC_HEADER_ANA_1_PEAK_TICK_INVALID MethodHeader error: the field "Analog1 PeakTicks" contains an invalid value. Possible cause is client application.

9406 MST_CC_HEADER_ANA_2_SOURCE_INVALID MethodHeader error: the field "Analog2 Source" contains an invalid value. Possible cause is client application.

9407 MST_CC_HEADER_ANA_2_PEAK_TICK_INVALID MethodHeader error: the field "Analog2 PeakTicks" contains an invalid value. Possible cause is client application.

9408 MST_CC_HEADER_PS_RELAY_MODE_INVALID MethodHeader error: the field "PeakSense Relay Mode" contains an invalid value. Possible cause is client application.

9409 MST_CC_HEADER_PS_DURATION_BELOW_MIN MethodHeader error: the field "PeakSense Relay Duration" is below the minimum allowed value. Possible cause is client application.

9410 MST_CC_HEADER_PS_DURATION_ABOVE_MAX MethodHeader error: the field "PeakSense Relay Duration" is above the minimum allowed value. Possible cause is client application.

9411 MST_CC_HEADER_PS_DELAY_BELOW_MIN MethodHeader error: the field "PeakSense Relay Delay" is below the minimum allowed value. Possible cause is client application.

9412 MST_CC_HEADER_PS_DELAY_ABOVE_MAX MethodHeader error: the field "PeakSense Relay Delay" is above the minimum allowed value. Possible cause is client application.

9413 MST_CC_HEADER_RESPONSE_TIME_INVALID MethodHeader error: the field "Response Time" contains an invalid value. Possible cause is client application.

9414 MST_CC_HEADER_BUNCHING_SIZE_INVALID MethodHeader error: the field "Bunching Size" contains an invalid value. Possible cause is client application.

9415 MST_CC_HEADER_NOISE_MON_LEN_BELOW_LIMIT MethodHeader error: the field "Noise Monitor Limit" is below the minimum allowed value. Possible cause is client application.

9416 MST_CC_HEADER_NOISE_MON_LEN_ABOVE_LIMIT MethodHeader error: the field "Noise Monitor Limit" is above the minimum allowed value. Possible cause is client application.

9417 MST_CC_RUNTIME_BELOW_LOWER_LIMIT
MethodLine error: the field "Run Time" is below the minimum allowed value. Possible cause is client application.

9418 MST_CC_RUNTIME_ABOVE_UPPER_LIMIT
MethodLine error: the field "Run Time" is above the minimum allowed value. Possible cause is client application.

9419 MST_CC_RUNTIME_LESS_THAN_PREVIOUS_LINE MethodLine error: the run time of the current line is less than the run time of the previous line. Method lines must be sent down in run time order. Check client application if lines are sent out of run time order.

9420 MST_CC_PARAM_INVALID_VALUE
MethodLine error: one of the lines parameters are in error. (non-specific as to which parameter). The response message has info on the line of concern.

9421 MST_CC_PARAM_BELOW_LOWER_LIMIT
Method error: unspecified parameter is below the minimum allowed value. Possible cause is client application.

9422 MST_CC_PARAM_ABOVE_UPPER_LIMIT
Method error: unspecified parameter is above the minimum allowed value. Possible cause is client application.

9423 MST_CC_METHOD_END_ACTION_INVALID
MethodLine error: The "end action" of the line is invalid.

9424 MST_CC_INVALID_SUBCOMMAND_TAG
MethodLine error: A parameter tag for one of the parameters on the line was invalid.

9425 MST_CC_TOO_MANY_PARAMS_ON_LINE
MethodLine error: A line contains more than the maximum allowed parameters (client application bug).

9428 MST_CC_NEW_END_TIME_ALREADY_PASSED
Client tried to change the end time of a running method to a time that has already passed. No change to the pre-existing end time was performed.

9429 MST_CC_CMD_ONLY_VALID_IN_RUNNING_STATE Command to change the End time of a running method is only valid in the RUNNING state.

9430 MST_CC_TOO_MANY_LINES_IN_METHOD
The downloaded method has more method lines than the maximum allowed

9432 MST_CC_FAILED_DOWNLOAD_RESEND_HEADER
Sent for each method line when the proceeding Method has failed in some way (either the method header or lines failure). The entire method will need to be resent again. If errors persist, check the values of each field in the Method header, and each method line.

9433 MST_CC_NOT_ENOUGH_PARAM_ON_FIRST_LINE
The first Method line is expected to have a certain number of parameters.

9434 MST_CC_CMD_NOT_VALID_IN_THIS_STATE
Method download is not valid in the current state. Change to Ready or stopped states and re-download the method.

9436 MST_CC_PARAM_AUTOZERO_1_INVALID
The entry for AutoZero1 in the method line is not valid. Possibly a messaging error.

9437 MST_CC_PARAM_AUTOZERO_2_INVALID
The entry for AutoZero2 in the method line is not valid. Possibly a messaging error.

9438 MST_CC_TS_PERIOD_LESSTHAN_OR_EQUALTO_PS_DURATION Time Slice period in method lines must be greater than the PeakSense duration in the method header.

9439 MST_CC_HEADER_MIN_WL_OUTSIDE_RANGE_LIMIT
The "minimum Wavelength" in Method Header is outside the allowed range (190 ~ 950nm).

9440 MST_CC_HEADER_MAX_WL_OUTSIDE_RANGE_LIMIT
The "maximum Wavelength" in Method Header is outside the allowed range (190 ~ 950nm).

9441 MST_CC_HEADER_MIN_WL_ABOVE_MAX_WL Minimum wavelength in method header has a value greater than the maximum wavelength in method header.

9442 MST_CC_HEADER_DIAG_METHOD_ENABLE_INVALID Invalid value for the Diagnostic method enable field in a method header.

9450 MST_CC_HEADER_SLITWIDTH_INVALID_IN_USER_MODE Slit value in Method header is not valid in Non-Diagnostic methods.

9451 MST_CC_HEADER_SLITWIDTH_INVALID
Slit value in Method header is not within the valid range.

9452 MST_CC_HEADER_BANDPASS_WIDTH_INVALID
The bandpass filter width value in Method header is not within the valid range.

9453 MST_CC_HEADER_BANDPASS_WIDTH_NOT_SET_FOR_AUTO User methods should have the bandpass width in Method header set for Automatic.

9455 MST_CC_HEADER_BYPASS_INVALID_IN_USER_MODE
As the bypass field is for use only in diagnostic methods it is invalid for the bypass field to have a non zero value in user methods.

9456 MST_CC_HEADER_MUST_ALSO_BYPASS_ZERO_CORR When the user is running a diagnostic method and has Abs conversion bypassed they MUST also bypass AutoZero.

9457 MST_CC_HEADER_MUST_ALSO_BYPASS_RANGE_EXTN When the user is running a diagnostic method and has AutoZero bypassed they must also bypass RangeExtn.

9458 MST_CC_LINE_RELAY1_PARAM_INVALID_VALUE MethodLine error: Relay1 has a value that is not valid.

9459 MST_CC_LINE_RELAY2_PARAM_INVALID_VALUE MethodLine error: Relay2 has a value that is not valid.

9460 MST_CC_LINE_RELAY3_PARAM_INVALID_VALUE MethodLine error: Relay3 has a value that is not valid.

9461 MST_CC_LINE_RELAY4_PARAM_INVALID_VALUE MethodLine error: Relay4 has a value that is not valid.

9462 MST_CC_LINE_PEAKSENSE_RELAY_INVALID_VALUE MethodLine error: The Peak Sense Realy has an invalid value.

9463 MST_CC_LINE_PEAKSENSE_WIDTH_INVALID_VALUE MethodLine error: The Peak Sense width parameter has an invalid value.

9464 MST_CC_LINE_TIMESLICE_TRIGGER_INVALID MethodLine error: The TimeSlice trigger parameter has an invalid value.

9465 MST_CC_LINE_SN_RATIO_BELOW_LOWER_LIMIT MethodLine error: The signal to noise ratio parameter is below the minimum allowed value. Possible cause is client application.

9466 MST_CC_LINE_SN_RATIO_ABOVE_UPPER_LIMIT MethodLine error: The signal to noise ratio parameter is above the maximum allowed value. Possible cause is client application.

9467 MST_CC_LINE_TS_PERIOD_BELOW_LOWER_LIMIT MethodLine error: The timeslice period parameter is below the minimum allowed value. Possible cause is client application.

9468 MST_CC_LINE_TS_PERIOD_ABOVE_UPPER_LIMIT MethodLine error: The timeslice period parameter is above the maximum allowed value. Possible cause is client application.

9469 MST_CC_LINE_PS_THRESHOLD_BELOW_LOWER_LIMIT MethodLine error: The peak sense threshold parameter is below the minimum allowed value. Possible cause is client application.

9470 MST_CC_LINE_PS_THRESHOLD_ABOVE_UPPER_LIMIT MethodLine error: The peak sense threshold parameter is above the maximum allowed value. Possible cause is client application.

9471 MST_CC_LINE_ANALOG_1_BELOW_LOWER_LIMIT MethodLine error: The Analog 1 attenuation parameter is below the minimum allowed value. Possible cause is client application.

9472 MST_CC_LINE_ANALOG_1_ABOVE_UPPER_LIMIT MethodLine error: The Analog 1 attenuation parameter is above the maximum allowed value. Possible cause is client application.

9473 MST_CC_LINE_ANALOG_2_BELOW_LOWER_LIMIT MethodLine error: The Analog 2 attenuation parameter is below the minimum allowed value. Possible cause is client application.

9474 MST_CC_LINE_ANALOG_2_ABOVE_UPPER_LIMIT MethodLine error: The Analog 2 attenuation parameter is above the maximum allowed value. Possible cause is client application.

9551 LMP_CC_VIS_LAMP_FAILURE
Failure to successfully strike the vis lamp. Suggests a faulty lamp.

9552 LMP_CC_VIS_LAMP_ALREADY_ON
Attempt to turn on Vis lamp when it is already on.

9553 LMP_CC_D2_LAMP_DIDNOT_STRIKE
Failed to sense correct Anode current after attempt to strike ARC.

9554 LMP_CC_D2_LAMP_ALREADY_ON
Attempt to turn on D2 lamp when it is already on.

9555 LMP_CC_D2_FILAMENT_FAILURE
Failed to sense D2 warming filament operation after turning on warming filament.

9556 LMP_CC_NOT_A_VALID_LAMP_SELECTION
Attempt to turn on a invalid lamp.

9557 LMP_CC_BOTH_LAMPS_ALREADY_ON
Attempt to turn on both lamps when both lamps are already on.

9558 LMP_CC_LAMP_ALREADY_OFF
Attempt to turn off a lamp that is already off.

9559 LMP_CC_LAMP_OFF_DURING_CALIBRATION
Calibration sequence is running and the lamp is off when it should be on.

9600 EEP_CC_SIZE_MISMATCH_IN_VID
Attempt to read or write data to EEPROM with the incorrect size of bytes.

9606 CMOS_CC_WRITE_CHECKSUM_FAIL
Attempt to write the checksum to CMOS storage failed with an unspecified error.

9607 CMOS_CC_WRITE_FAIL
Attempt to write data to CMOS storage failed with an unspecified error.

9635 LOG_CC_ERRLOG_ERROR_WRITING_TO_LOG
Error writing error code and time stamp to error log.

9637 LOG_CC_ERRLOG_INSUFFICIENT_READ_BUFFER
The buffer used to read the error log is too small.

9640 LOG_CC_RUNLOG_EMPTY
Attempt to read an empty runlog. This is the only possible response that firmware can give to the client when there is no data in the runlog to report.

9641 LOG_CC_RUNLOG_INSUFFICIENT_READ_BUFFER
The buffer used to read the run log is too small.

9642 LOG_CC_RUNLOG_NO_COMMS_BUFFER
The function used to read the error log was not passed a valid buffer.

9643 LOG_CC_RUNLOG_DELAY_TOO_LONG_RE_INIT
Reading the run log is a multiple message sequence. To prevent lock up commands, the detector has a watchdog timer on the request to read the runlog, This error indicates that the client took to long between phases of reading the run log.

9644 LOG_CC_ERRLOG_SUCCESSFULLY_CLEARED
Used as a marker in the errorlog to timestamp when the error log was last cleared.

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